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) Color Prints
) Photography.

MODERN ENLARGING TECHNIQUE

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by

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INTRODUCTION

In the writing of this book the Authors have attempted a difficult task—that of producing a really complete and authoritative work on the subject of enlarging that will meet the needs of both amateur and professional photographer. Little of real value has been excluded and nothing has been put in merely to add to the number of pages.

To any possible criticisms that too much has been made of the theory of enlargers and the enlarging process, the answer is that complete understanding of these matters is of very real help in the production of first-class prints—the only criterion by which photography should be judged. With a little help, anybody can make a presentable enlargement, but the making of the very best enlargement a negative can yield—not occasionally but nearly every time—demands skill of a very high order. While this skill can be attained by constant practice alone over a long period, it can be developed more readily when the photographer has a sound knowledge of the optical, mechanical, and chemical processes he is making use of. Such is the firm belief of the authors.

The aim in including some characteristic curves of papers used for enlarging, and the discussions of their properties is to clarify such terms as 'contrast', 'exposure scale' and similar ones which are often misunderstood, and used loosely.

The practical details of enlarging have been dealt with at some length, and the methods described have stood the test of long and regular use.

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GEORGE L. WAKEFIELD, F.I.B.P., F.R.P.S.

Manchester 1953

Chapter 1

HOW AN ENLARGER WORKS

ENLARGING is exactly the same optically as negative making with a camera. The negative in the enlarger forms the subject and an image of it is projected by a lens on to a sheet of light-sensitive paper which serves the same purpose as the film in a camera. Fig. 1 shows the relative positions of negative, lens, and printing paper when making an enlargement and in Fig. 2 is shown the same thing but for a print or lantern-slide made by reduction. Provided that the lens in an enlarger can be moved far enough away from the negative it is just as easy to project an image which is *smaller* than the negative as to make an enlargement. This is not often done by the amateur and for that reason not every enlarger is provided with enough bellows extension for reducing.

Illumination of the Negative

The first requirement in an enlarger is powerful and even illumination of the negative from behind. It is not sufficient just to place a powerful lamp behind it; the light may be strong enough but it would not be even. One reason for the unevenness can be seen from Fig. 3. The light has further to travel from the lamp to the edges of the negative than from the lamp to the centre of the negative, and the strength of illumination on a surface is inversely proportional to the square of the distance between the light source and the surface. Also, the light at the edges of the negative strikes it more obliquely than that at the centre, which again results in diminution of illumination.

The foregoing points are not vitally important, as all negatives are denser in the centre than at the edges due to the uneven illumination of the image in the camera. In Fig. 4 is

shown the main reason why it is not sufficient to light the negative with just a lamp. Ignoring for a moment the fact that a silver image scatters the light passing through it, it will be seen that in forming an image of the illuminated negative, the lens cannot receive any of the light coming through the edges of the negative. In fact, the projected image will consist of only a small bright patch which rapidly falls off to darkness. As the silver image of the negative *does* scatter the light as it passes through, the falling off to darkness will not be complete, but the projected image will be, nevertheless, hopelessly uneven.

If it were possible to illuminate the negative with a very large light source—somewhat bigger than the negative in fact—even illumination could be secured without any difficulty. This is a practicable solution to the problem but other devices are generally used.

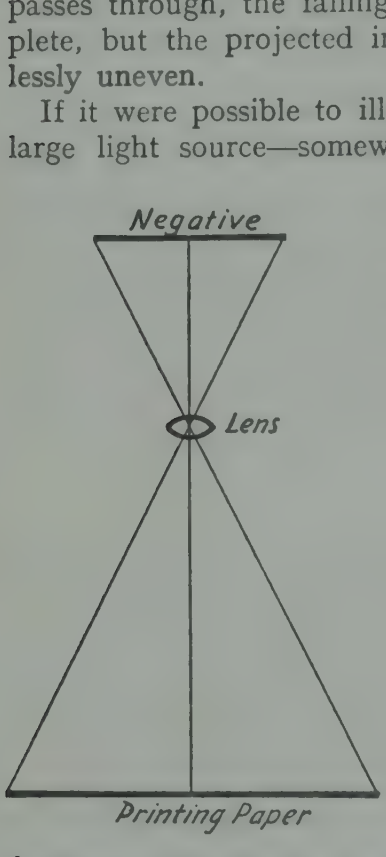
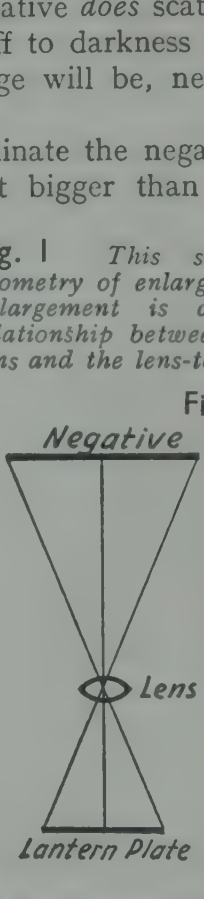


Fig. 1 *This shows the simple geometry of enlarging. The degree of enlargement is dependent on the relationship between the negative-to-lens and the lens-to-paper distances.*

Fig. 2



Here is the situation when an enlarger is set for projecting an image smaller than the negative such as in making lantern slides by reduction. It will be noted that the lens - to - image distance is smaller than the negative - to-lens distance.

Diffused Illumination

Two remedies are available for the uneven illumination. We

can place a diffuser of ground or opal glass between the lamp and the negative so that the light passes through the negative in many directions as shown in Fig. 5. In effect, the diffusing

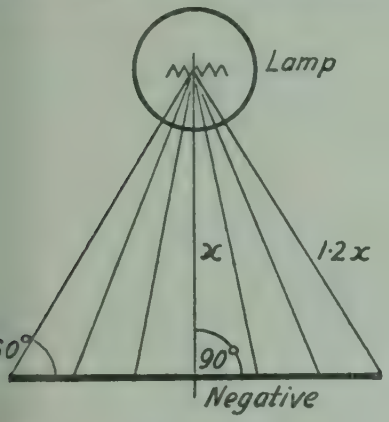


Fig. 3 *Showing one of the reasons why a negative cannot be evenly illuminated merely by placing a lamp behind it. The edges of the negative are further from the lamp than is the centre: also, the light rays strike the edges of the negative obliquely, instead of normally, as they strike the centre.*

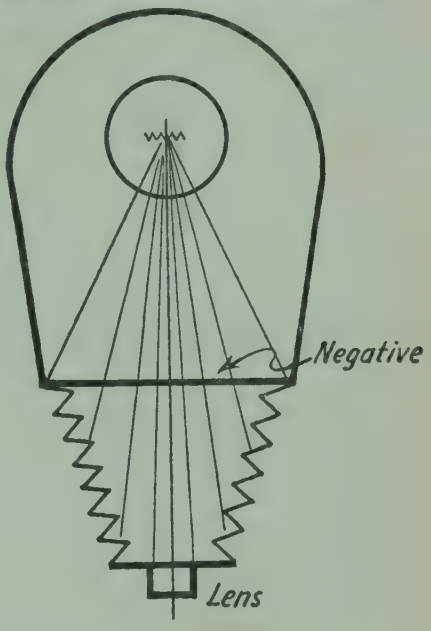


Fig. 4 *The main reason why just placing a lamp behind the negative in an enlarger cannot give an evenly illuminated image on the easel is shown here. Ignoring any scatter by the silver deposit in the negative, light passing through any but the central area of the negative does not reach the enlarger lens but is lost by absorption by the bellows.*

screen now becomes the source of light and as can be seen from the diagram, it is a little larger than the negative. Such an arrangement is often referred to as an ' extended source '. It gives fairly even illumination of the negative but not perfectly so as a rule. No opal or ground glass is a perfect diffusing medium. Two layers of opal glass with about an inch space between them will improve matters but at the cost of considerable loss of light. The diffuser system can incorporate a sheet of glass with a sand-blasted patch in the centre and this improves the evenness, or, it is possible to

place discs of tissue paper on the diffusing glass as shown in Fig. 6. This can be effective but tissue paper gradually goes brown with the heat from the lamp and requires frequent renewal.

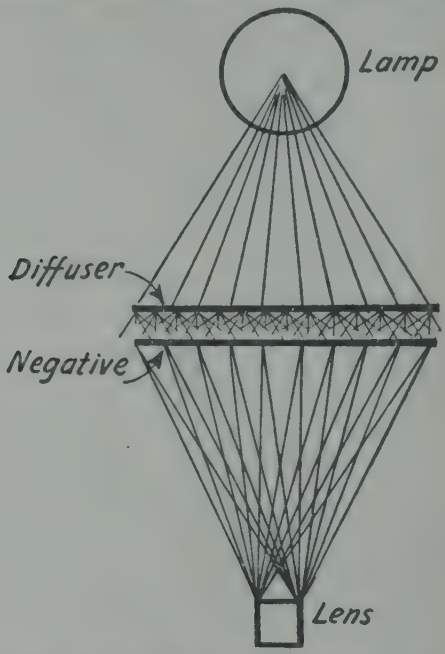


Fig. 5

This shows the optical arrangement of a diffused light enlarger. Between the lamp and the negative is placed a diffusing screen of ground or opal glass which scatters the light from the lamp so that it passes through the negative at all angles. Compare this with Fig. 4.

Diffuser type enlargers are widely used especially for large negatives where the cost of a condenser and also its weight would be prohibitive. They suffer from two disadvantages: first, the difficulty of securing perfectly even illumination, and second, waste of light. As can be seen from Fig. 5 much of the light passing through the negative never reaches the lens but is absorbed by the bellows of the enlarger. A powerful light source is therefore essential, and this in turn, necessitates a large and efficiently ventilated lamphouse. The lamphouse is shaped so that as much of the light as possible is directed towards the negative and the inside of the lamphouse is matt white or aluminized to form an efficient reflecting surface.

Cold Light Sources

Mercury vapour and fluorescent tubular lamps can be used for enlarging and as they produce very little heat they simplify

the problems of ventilation of the lamphouse and do not overheat the negative. This type of lighting is becoming quite widely used in enlargers to take big negatives, the tube being arranged in a zig-zag pattern just above the negative with a diffuser between the two. It would seem likely that fluorescent lamps will be developed in forms suitable for use in small enlargers for this type of lighting is still far from fully developed and has great potentialities.

Condenser Illumination

From the point of view of making the most of the available light a condenser is the most efficient device for illuminating a negative evenly. This arrangement is shown in Fig. 7. The condenser consists usually of two plano-convex lenses placed with their convex surfaces nearly touching each other, but

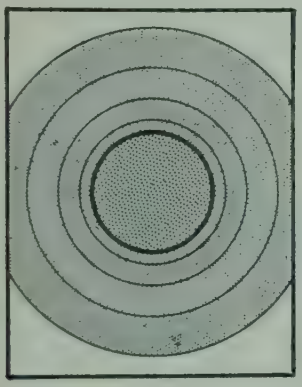
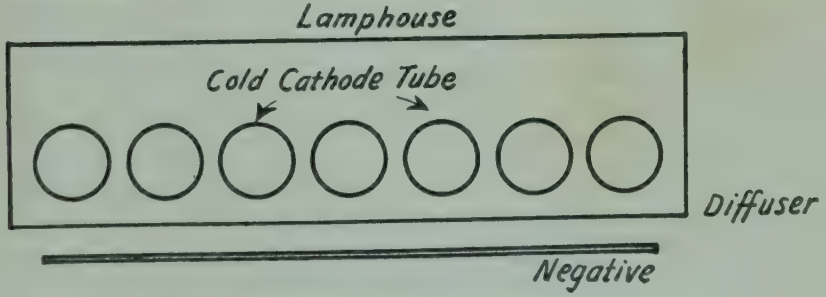


Fig. 6 *As neither ground nor opal glasses are perfect diffusers, a diffused light enlarger generally gives slightly less illumination at the edges of the image than at the centre. This can be overcome by placing a number of discs of tissue paper on the diffusing glass as shown here. As there are more thicknesses of paper in the centre than at the edges the light at the centre is reduced.*

Fig. 6a *A sectional view (schematic) of a lamphouse fitted with cold cathode illuminant.*



for illuminating small negatives it can consist of one plano-convex lens with the plane surface facing the negative. The function of the condenser is to collect as much light as possible

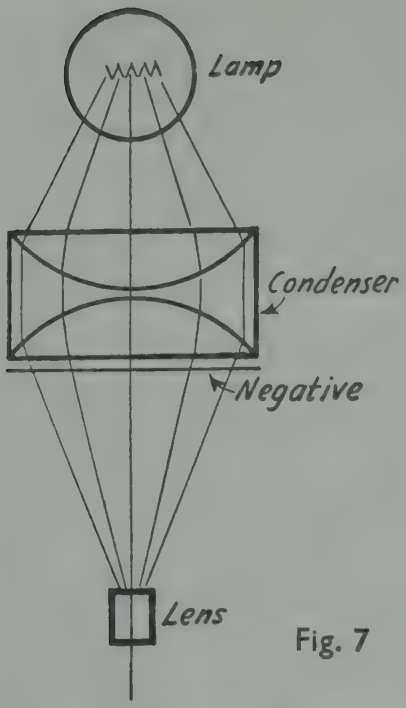


Fig. 7

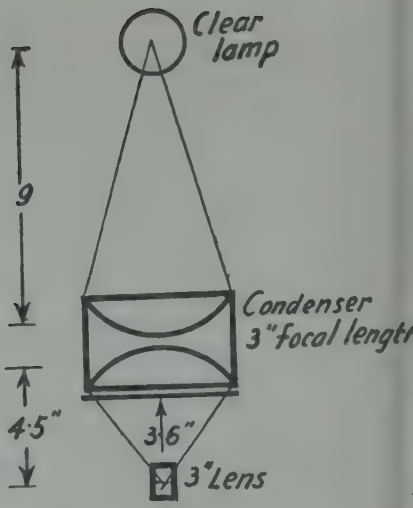


Fig. 8

FIG. 7. *A double plano-convex condenser is one of the most popular devices for evenly illuminating the negative and at the same time it is highly efficient from the point of view of making best use of the available light. The condenser focusses the light falling on its rear face and projects an image of the light source in the enlarger lens.*

FIG. 8. *This dimensioned drawing shows the various optical distances when using a condenser with a focal length of three inches, an enlarging lens of the same focal length, and a degree of enlargement of five diameters. A condenser of shorter focal length would enable the lamp to condenser distance to be shortened with a gain in efficiency.*

from the lamp, and to pass it through the negative and focus it in the enlarger lens.

Early condenser enlargers were fitted with a clear lamp with a very compact filament that approached very nearly to a point source illuminant. A carbon arc, limelight, or acetylene flame were also used sometimes. A point source illuminant with a condenser is a highly efficient system as far as making the most of the light is concerned—a valuable asset in the days before rapid enlarging lenses and fast printing papers. Modern

condenser enlargers always have an opal or white-sprayed lamp—a less efficient system but one with certain advantages over the condenser and point source arrangement.

Point Source Illuminants

As there are condenser and point source enlargers still in use, their optical principles may be of interest. The focal length of the condenser should be short so that the lamp can be placed as close to it as is practicable. The nearer it is, the more light goes through the condenser, but if it is too close excessive heat may cause the rear condenser lens to crack. A condenser with a focal length roughly the same as that of the enlarger lens is usually employed, but a slightly shorter focal length is better.

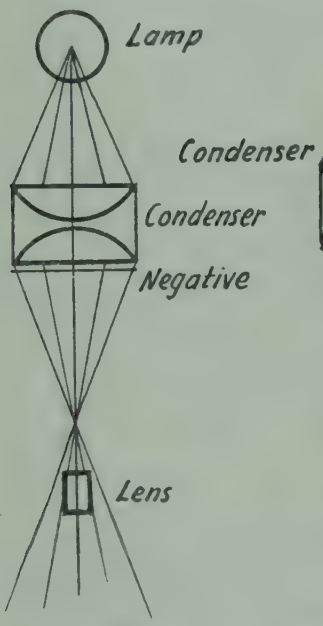


Fig. 8a

Fig. 8b

FIG. 8a. *With a condenser and point source illuminant it is essential that the light should be focussed in the enlarger lens. Here it is focussed just behind the lens and under these conditions the illumination of the image on the easel would be uneven.*

FIG. 8b. *Here the light from the condenser is focussed in front of the enlarger lens which again will result in uneven illumination of the image on the easel.*

When the enlarger lens is projecting a sharp image of the negative of the required size, the distance between lamp and condenser has to be adjusted so that the filament of the lamp is focussed in the enlarger lens. This condition is essential if the projected image is to be evenly illuminated. In Figs. 8a and 8b is shown the situation which exists when the lamp-to-condenser distance is incorrect for the negative-to-lens distance. In both cases the edges of the image will be under-illuminated. Here lies one of the disadvantages of a point source and condenser enlarger—the lamp has to be focussed every time the degree of enlargement is altered more than a very little.

Centring the Lamp

In addition to the necessity for focussing the light source it must also be accurately centred with the condenser and the lens with the condenser as shown in Fig. 9. This adjustment has only to be carried out once unless the enlarger is disturbed for any reason. When once the lamp has been centred with the condenser it can be locked in position and need not be touched further except to adjust its distance from the condenser as required. The mounting of the lamp in the older types of horizontal enlarger is designed so that the illuminant can be moved up and down and from side to side. The mounting itself slides in the lamphouse for purposes of focussing, or sometimes the lamphouse itself runs on a rack and pinion mechanism as shown in the drawing on page 32.

The Reflector

When a clear lamp with a bunched filament is used, a concave mirror may be provided so that much of the light emitted by the light source towards the rear of the enlarger is collected and focussed just alongside the filament. This effectively doubles the amount of light passing through the condenser. The reflector is not essential in these days of fast lenses and printing papers ; in fact, the problem with enlargers of this kind is often in the shortness of exposure times, and it is not feasible to use a small lens aperture to make exposure times longer because such a procedure results in uneven illumina-

tion. Often it is impossible to stop down more than one stop without introducing unevenness.

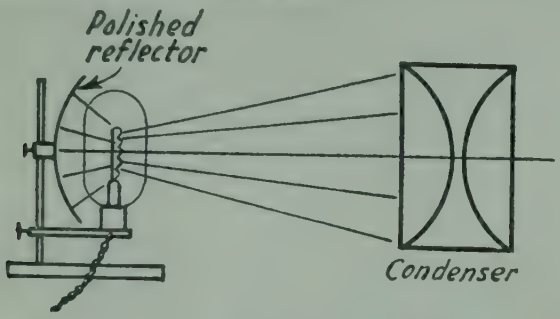


Fig. 9

Although a point source illuminant is not widely used these days it is highly efficient, especially if a polished focussing reflector is used as shown here. As a point source lamp has to be accurately centred with the condenser it is generally mounted on an adjustable stand which permits it to be raised and lowered, and also moved from side to side.

The Callier Effect

Another feature of the condenser and point source enlarger is that it gives an image of high contrast because of the Callier effect, which is due to light scatter by the silver image of the negative. The light passing through the negative from the condenser is scattered by the silver grains, and more scattering takes place in the highlights of a negative than in the shadows for the obvious reason that the latter areas contain the least silver.

In Fig. 10 the Callier effect is shown diagrammatically. At A is a highlight tone ; the scattering of the light is considerable, and as can be seen, much of the scattered light never reaches the enlarger lens. Thus, the highlight areas of the negative are made denser in effect with this type of enlarger than when say, contact printing, where *all* the light passing through the negative reaches the printing paper. At B in Fig. 10 is a shadow area and the proportion of light lost by scatter is small because there is very little silver there to cause scatter.

Not only is the contrast of the projected image high with a condenser and point source illuminant but defects such as scratches, abrasions, fingermarks and so forth are emphasised

in the enlargement. So also is retouching; even the area of a negative treated with retouching medium can often be plainly seen in the print because of the reduction of surface

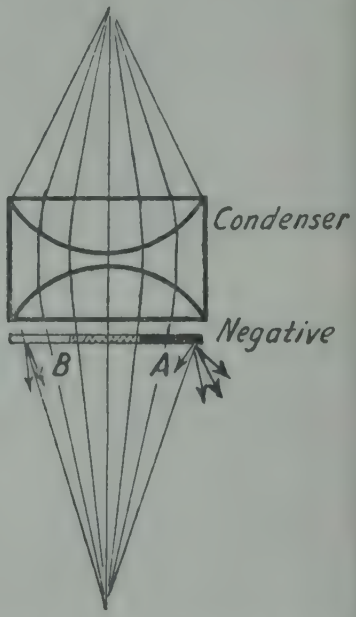


Fig. 10

This diagram shows the reason for the Callier effect. A and B are highlights and shadows respectively in the negative and the large amount of scatter by the former is shown. This matter is fully explained in the text.

scatter by the medium. Any graininess in the negative too is reproduced vividly.

The Callier effect can be put to good use occasionally by the photographer who has two enlargers at his disposal, one fitted with a condenser and point source lamp and the other a diffused light system. If with the latter he finds an enlargement a little soft in contrast, he can change to the former and secure more contrast without changing the grade of printing paper. Conversely, he can secure a reduction in contrast with the same paper by changing from the condenser enlarger to the diffused type.

Condenser and Opal Lamp System

Most modern enlargers designed for use with small negatives —up to about quarter-plate—make use of a condenser to secure even illumination but instead of a lamp with a small compact filament, an opal or white-sprayed lamp is used. This

is not quite such an efficient arrangement as it wastes some of the light but it gives even illumination and the Callier effect is only just noticeable. Also, the lens can be stopped down without making the illumination of the image uneven. Fig. 11 shows the optics of the condenser and opal lamp system of illumination. The condenser forms an image of the lamp at the position of the lens and it will be seen from the diagram

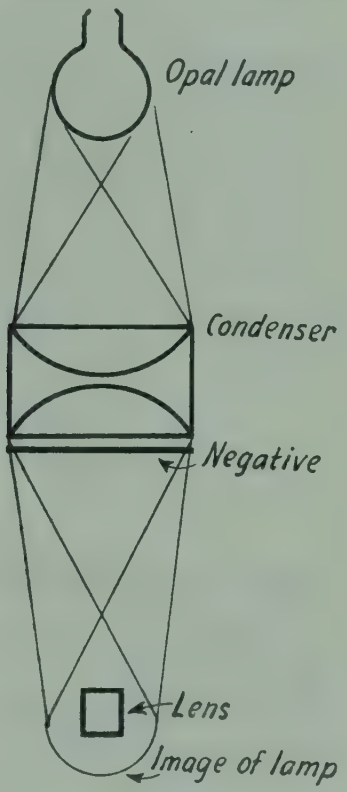


Fig. 11

Modern condenser enlargers generally make use of an opal or a white-sprayed lamp. The condenser forms an image of the lamp at about the position of the enlarger lens, but the position of the image is far less critical than when a point source illuminant is employed.

that the light falling on the negative is partly scattered. The contrast of the image given by a condenser and opal lamp is a little higher than that given by a diffused illuminant.

The Callier effect is non-existent with a diffused light enlarger. The negative image is still capable of scattering light but as the illumination has already been scattered by the opal or ground glasses between lamp and negative, there is no

increase in the contrast of the image. It will be appreciated that with diffused lighting, while a ray of light travelling towards the lens may be diverted by the silver image of the negative and be lost through absorption by the bellows, it is equally likely that another ray *not* travelling towards the lens will be changed in direction by the silver image so that it now reaches the lens. In this way the effects of scatter by the negative are cancelled out.

To return to the popular scheme of the condenser plus opal lamp, it has another advantage over the condenser and point source system. There is generally no need to alter the distance between lamp and condenser when the degree of enlargement is changed. Neither is the centering of the lamp so critical as when one with a compact filament is employed.

It should be pointed out that a condenser and point source illumination system can be converted to the equivalent of a condenser and opal lamp, either temporarily or permanently, merely by fixing a sheet of flashed opal glass between the lamp and the rear of the condenser and as near to the condenser as

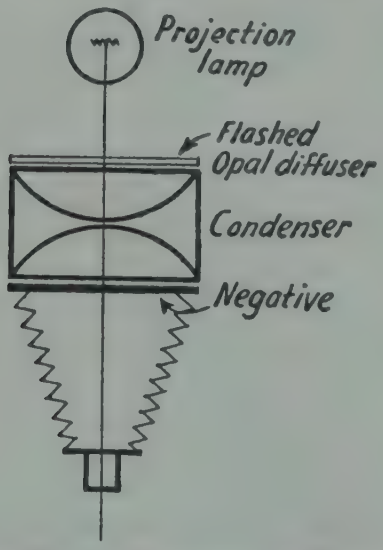


Fig. 12

An old type enlarger fitted with a lamp with a compact filament can be converted to the equivalent of a condenser and opal lamp instrument merely by placing a diffuser of ground or opal glass between the lamp and the condenser as shown here.

possible for the sake of efficiency—see Fig. 12. If desired, the projector type lamp can be replaced with an opal lamp instead of using a diffuser screen, but the latter enables a

500 watt lamp to be used for the sake of short exposure times, whereas opal and white-sprayed lamps are not readily available above 150 watts.

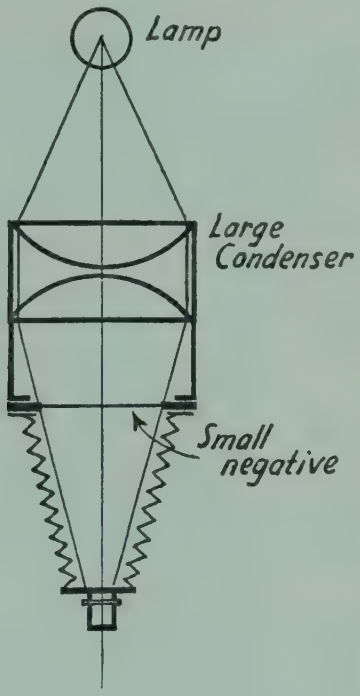


Fig. 13

If in building an enlarger one is forced to use an existing condenser which is larger than the biggest negative ever likely to be enlarged the arrangement shown here is more efficient than the one where the negative is placed almost in contact with the condenser.

Illumination Efficiency

As has been mentioned previously, the need for a high efficiency system of illumination in an enlarger is much less today than it was years ago. Printing papers—even the chlorobromide varieties—are much faster than they were, and enlarging lenses are available with apertures of up to f/3.5. These two factors together make for short printing exposures even when a low-powered lamp is used, provided that negatives are fairly thin. Unfortunately, many manufacturers of enlargers seem to think that photographers never have to enlarge dense negatives ; never wish to use one of the slower chlorobromide papers, and are always content with a moderate degree of enlargement. The tendency is to design lamphouses to take nothing larger than about a 75 watt lamp, which is

ridiculous. One well-known enlarger for negatives up to $2\frac{1}{4}$ inches square takes only a 60 watt lamp. A much higher power lamp, up to 150 or 200 watts may be convenient or even essential sometimes unless very long exposures indeed can be tolerated.

Photoflood Lamps

When a powerful light source is required there are those who recommend the use of a No. 1 Photoflood, but this radiates so much heat that a generously proportioned lamphouse with excellent ventilation is necessary. Heat-absorbing glass is desirable between lamp and condenser to take care of radiated heat which can quickly buckle and ruin a film negative. An essential precaution is to keep the lamp burning for only as long as it takes to focus and expose. It should be borne in mind that as the Photoflood lamp has a pearl and not an opal bulb this may give rise to unevenness in the illumination of the image. A sheet of flashed opal glass placed over the rear face of the condenser will cure the trouble without undue loss of light.

As the Photoflood lamp gives a light output equivalent to that of an ordinary 800 watt lamp and is also richer in violet and blue rays than the household type of lamp, exposures are reduced to less than one-tenth.

Special Lamps for Enlarging

There are now enlarger lamps available which are slightly overrun—not so much as a Photoflood lamp—but enough to provide much more light than that from a conventional 60 or 75 watt lamp. At the time of writing these high intensity lamps are made in two sizes: small, the same size as a 40 watt household lamp giving 40 per cent. more light than an ordinary 60 watt lamp, and large, the same size as a 60 watt lamp giving 66 per cent. more light than a 150 watt lamp.

The Condenser

Something now about the condenser which forms part of so many enlargers. As mentioned previously it generally consists of two plano-convex lenses arranged with the convex

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Showing how a
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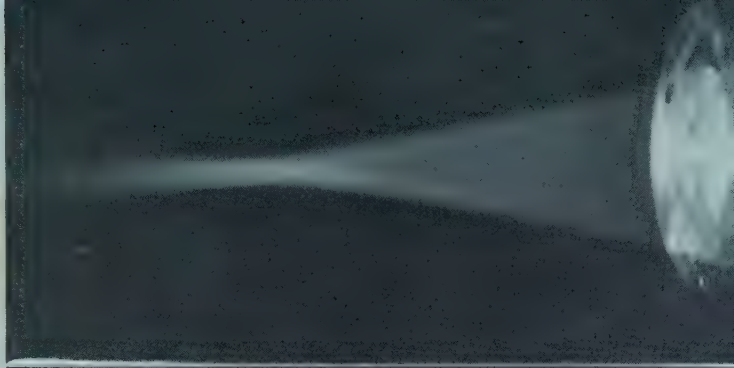

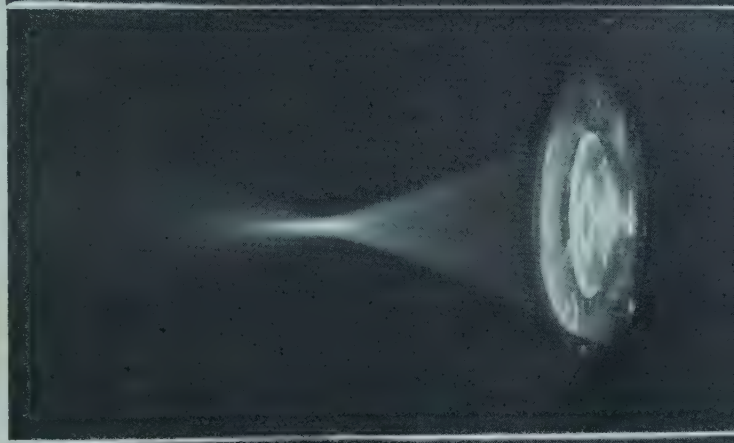

On the left is a opal type enlarge lamp now used a most universally i condenser enlarg ers. The lamp o the right is of th projector type wit a compact filamer with which th Callier effect is ver pronounced. Suc a lamp is still use where high effi ciency is needed.

A double plano convex condense showing the tw lenses, the cell i which the lense are mounted, an the spring space which keeps th lenses in position Condenser lense should be washe in warm—not ho —soapy wate periodically to re move the dirt whic always collects o them.

This illustration shows the differ ence between th maximum densitie obtainable o glossy and smoot matt printing papers. Th letter "M" is o matt paper and th background o glossy.

our prints show the small variations of contrast that can be secured on one grade
nde paper by the use of different developers. The developers used were: Plain
op left). A soft working metol hydroquinone developer (Kodak D 61a) designed
tive materials *(top right)*. (Kodak D1 63.) A normal metol hydroquinone developer
rade papers *(bottom left)*. A caustic hydroquinone developer *(bottom right)*.

PAPER CONTRAST

These three pi
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clogged up.

surfaces nearly touching each other. One lens could be used instead of two, but the double lens arrangement enables the short focal length to be secured without excessive curvature of the convex surface and enables some correction to be introduced for spherical aberration. Small condensers for miniature enlargers taking 35 mm. negatives are, nevertheless, often single lenses.

High optical quality is not required in a condenser and the lenses can even be of moulded glass, making them cheaper than ground and polished ones. Bubbles and other defects which are common in moulded glass lenses can give rise to dark marks in the projected image especially when working with a small lens aperture. For this reason the best condensers consist of optically worked lenses. They are usually mounted in a cell of blackened brass (see page 24) so that the condenser forms a self-contained unit which can be removed from the enlarger for cleaning purposes. An alternative arrangement is one in which the condenser mounting is part of the enlarger and only the lenses are removable.

Ventilation must be provided between the two condenser lenses so that persistent condensation does not occur, and to allow for the expansion of the glass when warmed by the heat from the lamp the lenses must be quite a loose fit in their mount.

Size of Condenser

It will be appreciated from the optics of a condenser that it cannot illuminate a negative any larger than itself. The diameter of the condenser must be at least equal to the length of the diagonal of the biggest negative that it is proposed to enlarge. Even this is only adequate where the negative is in a position almost in contact with the front plane surface of the condenser. In practice, a condenser is always a little bigger than the largest negative taken by the enlarger. The following table gives the minimum diameter of condenser for various popular negative sizes. This minimum can, of course, be exceeded without detriment, in fact, if one is making an enlarger and already has a larger condenser, an efficient ar-

rangement is possible such as is shown in Fig. 13. Better use is being made of the available light than if the negative were placed close to the large condenser.

TABLE OF MINIMUM CONDENSER DIAMETERS

NEGATIVE SIZE			MINIMUM CONDENSER DIAMETER	
35 mm.	36 x 24 mm.	$1\frac{7}{16}$ x $\frac{15}{16}$ ins.	4.5 cm.	$1\frac{3}{4}$ ins.
$\frac{1}{2}$ 127	4 x 3 cm.	$1\frac{9}{16}$ x $1\frac{3}{16}$ ins.	5.0 cm.	2 ins.
—	4 x 4 cm.	$1\frac{9}{16}$ x $1\frac{9}{16}$ ins.	6.0 cm.	$2\frac{1}{4}$ ins.
$\frac{1}{2}$ 120	6 x 4.5 cm.	$2\frac{3}{8}$ x $1\frac{3}{4}$ ins.	7.5 cm.	3 ins.
127	6.3 x 4.1 cm.	$2\frac{1}{2}$ x $1\frac{5}{8}$ ins.	7.5 cm.	3 ins.
—	6 x 6 cm.	$2\frac{1}{4}$ x $2\frac{1}{4}$ ins.	8.5 cm.	$3\frac{3}{8}$ ins.
120	8.2 x 5.7 cm.	$3\frac{1}{4}$ x $2\frac{1}{4}$ ins.	10 cm.	4 ins.
—	8.9 x 6.3 cm.	$3\frac{1}{2}$ x $2\frac{1}{2}$ ins.	11 cm.	$4\frac{5}{16}$ ins.
$\frac{1}{4}$ plate	10.8 x 8.2 cm.	$4\frac{1}{4}$ x $3\frac{1}{4}$ ins.	13.5 cm.	$5\frac{3}{8}$ ins.
—	12 x 9 cm.	$4\frac{3}{4}$ x $3\frac{1}{2}$ ins.	14.5 cm.	$5\frac{3}{4}$ ins.
—	12.7 x 10.2 cm.	5 x 4 ins.	16.5 cm.	$6\frac{1}{2}$ ins.
Postcard	14 x 9 cm.	$5\frac{1}{2}$ x $3\frac{1}{2}$ ins.	17 cm.	$6\frac{3}{4}$ ins.
$\frac{1}{2}$ plate	16.5 x 12 cm.	$6\frac{1}{2}$ x $4\frac{3}{4}$ ins.	20.5 cm.	8 ins.

The diameters given in the above table are the absolute minimum and are based on the assumption that the negative is touching the condenser. Ideally, at least $\frac{1}{8}$ inch (0.3 cm.) should be added to these figures when buying a condenser.

Lenses for Enlarging

The next, and highly important component of an enlarger is the lens. Its quality determines the definition of the enlargements made with it, and any old lens just will not do. The corrections required in an enlarging lens are more or less the same as those needed in a good camera lens with certain differences.

A camera lens is designed for use with comparatively large lens-to-object distances—many feet—and it is computed on the basis of parallel light; that is, for objects at infinity. In enlarging, the negative-to-lens distance is short, rarely exceeding twice the focal length of the lens, and the corrections of even a good camera lens may not be good at such short distances. Photographers who build their own enlargers must not therefore count on being able to use the lens of their

amera with it. Results may be good or they may not; it epends on the particular lens.

The suitability of a camera lens for enlarging purposes can e determined by experiment, or by writing to the makers if he latter course is practicable. It may be found on testing a ens that while at full aperture the definition leaves something o be desired, stopping down one or two stops may make it atisfactory. In the event of failure it is worth trying the lens urned round so that the front of it faces the negative instead f the printing paper.

Good colour correction is required in a lens intended for nlarging. Certainly the violet light to which printing papers re most sensitive must come to the same focus as the yellow-reen light, which, being the brightest spectral region to the ye, is that which is used mainly in visual focussing. As olour separation negatives from colour transparencies are ow often made with the enlarger, the fullest possible colour orrection for both axial and lateral chromatic aberration is esirable. Some printing papers are slightly colour sensitized n order to give them adequate speed, a fact which must be orne in mind when considering what degree of colour cor-ection is desirable in the enlarger lens.

The lens must have as flat a field as possible for the sake of ood definition over the whole of the print. In practice mar-inal definition is never as good as that in the centre of the ield owing to residual coma and astigmatism, but the falling ff, even at full aperture, is slight with a good lens. It must be emembered that the marginal definition in a negative is never s good as the central definition and if this effect is added to luring the enlarging process it is likely to become un-leasantly noticeable.

Maximum Apertures

The largest aperture of the enlarging lens is worth considera-ion. The bigger this is, the shorter will be the exposure times or a given set of conditions—very important when one is onfronted with a dense negative it is wished to enlarge greatly. A large aperture means a brighter image on the easel and

therefore easier focussing. Enlarging anastigmats are available which work at f/3.5 which is big enough for most purposes. It may be that the photographer finds the lens of his miniature camera suitable for enlarging and if the maximum aperture is f/2 he may be tempted to congratulate himself that he has a really fast lens. It is likely however that the best overall definition is secured with it stopped down one or two stops and this point should be carefully checked. When the aperture for the best performance has been determined, focussing should be carried out at this aperture as the focal length may alter a little on stopping down. With a lens designed expressly for enlarging it is better to focus at full aperture and then to stop down if necessary.

Stopping Down

As no problems of depth of field or depth of focus exist in the enlarging process, the subject, i.e. the negative, being a single plane surface and the enlarger easel rarely being tilted, it may be wondered if there is any need to stop down at all. In practice, there is, for the following reasons:—

1. It is impossible to focus with absolute accuracy and stopping down will help to counteract the effects of any small error.

2. Negative and printing paper may neither be perfectly flat and the use of an aperture smaller than the largest will improve definition.

3. Residual aberrations in the lens will be counteracted with improvement of marginal definition and possibly of central definition as well.

Diffraction Effects

Excessive stopping down of the enlarger lens is not to be recommended. A small aperture makes the effects of diffraction apparent enough to take the keen edge off the definition of an enlargement. Diffraction effects are more likely to be troublesome with an enlarger than in a camera. Another bad effect of stopping down is to so diminish the intensity of the light falling on the printing paper that failure of the reciprocity law may arise with consequent loss of contrast. The optimum lens

perture is best found by experiment, but two stops below the argest should prove generally satisfactory.

A valuable function of the lens diaphragm is in controlling xposure times. With a thin negative it may be necessary to top down in order to bring the exposure time to a manageable ength. Anything shorter than 5 seconds is too short for accurate timing especially if any shading or printing up is required. Sometimes it may be desirable to expose at full aperture owing to the high density of a negative, the slow speed of the paper, or other factors causing long exposure times. In such cases one has to accept the possibly inferior definition for the ake of speed.

Marginal Definition

The authors have noticed that some of the modern wide perture enlarging lenses do not give adequate marginal efinition at full aperture. This should not be so. While it annot be expected that marginal definition should be as good s that in the centre of the field, it should not be markedly nferior. Any lens suspected of poor performance in this irection should be returned to the makers for testing, but efore doing this, it should be made quite sure that any lack f sharpness in enlargements is due to the lens and not to other auses.

Horizontal Enlargers

Having seen something of the optical principles of an enlarger, et us see how they are put into practice. Enlargers are of two eneral kinds—horizontal and vertical. The horizontal type is ow rarely made except for large negatives and for professional use, but many amateurs use old ones of this kind and nd them very satisfactory. Fig 14 shows a side view of a ypical horizontal enlarger with its various parts. The lamphouse is of thin sheet iron and contains a point source projector lamp mounted on an adjustable stand which permits he filament to be accurately centred with the condenser and so enables rough focussing of the light source to be carried ut. The lamphouse as a whole can be moved nearer to or rther from the condenser for focussing the lamp whenever

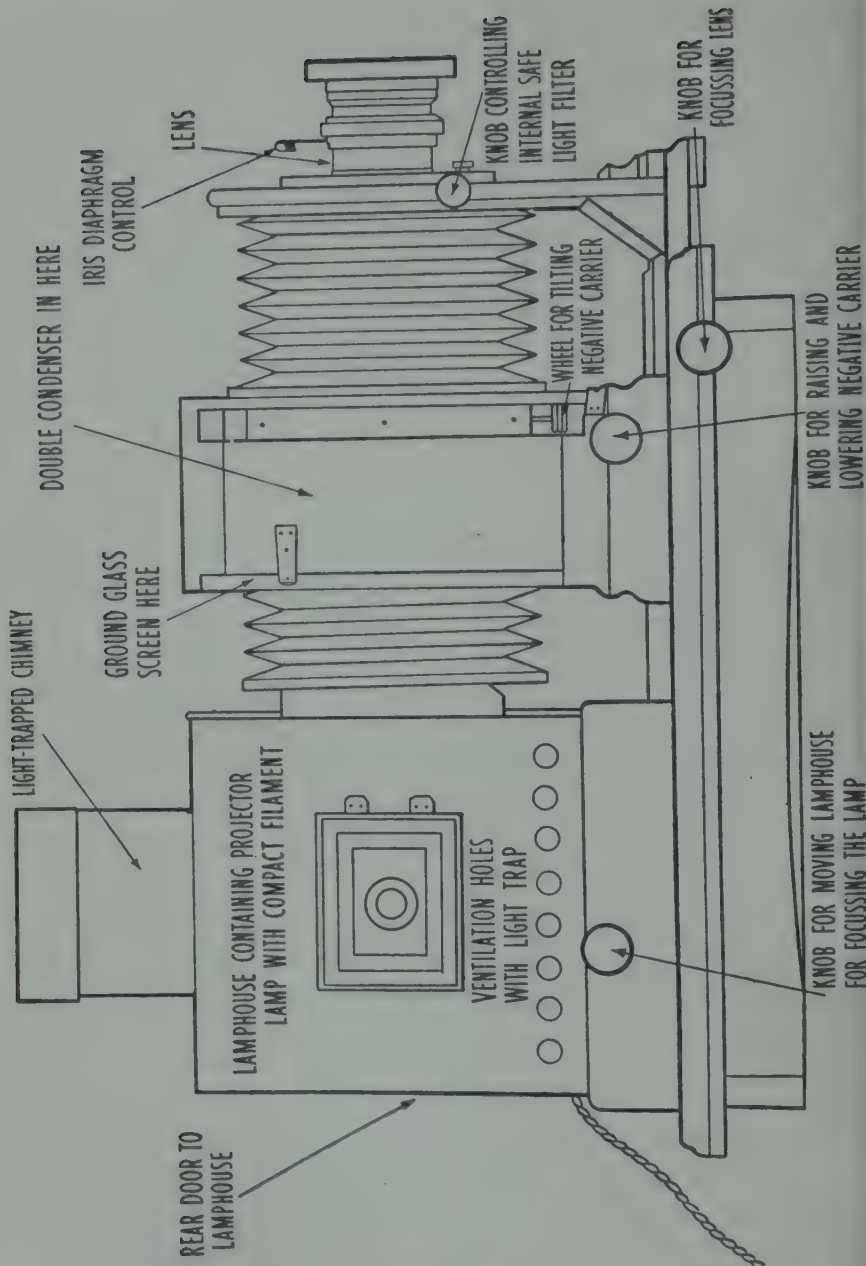


Fig. 14

Side view of a typical horizontal enlarger taking negatives up to half-plate and fitted with all desirable movements.

ne degree of enlargement is changed. A rack and pinion nechanism is provided for this purpose and the lamphouse nd condenser housing are connected by light-tight bellows. Although the particular enlarger illustrated was designed or use with a compact filament lamp, there is provision for tting a ground or opal glass diffusing screen close to the rear f the condenser, and there is no good reason why an opal amp should not be used in place of the projector lamp. Either f these modifications would mean longer printing exposures, ut if these could be tolerated, the reduction of the Callier ffect and the obviating of the need to keep focussing the ght source are worthwhile advantages. If for any reason the igh contrast characteristics of the condenser and point source ystem are wanted it is only the work of a minute or so to hange over.

djustable Negative Carriers

n front of the condenser and very close to its plane face is a ide for holding the negative carrier. The latter has move- ents for raising and lowering the negative and for moving it om side to side so that any required portion of the image can e centred on the easel. Provision is made also for rotating the egative slightly for the correction of leaning verticals or pped horizons. Small tilting movement of the negative is ossible for the correction of slightly converging verticals, ut it is a small movement and therefore of no great value. hese movements of the negative carrier are invaluable to the rofessional photographer and the advanced amateur and are rely found on vertical enlargers.

ocussing Mechanism

or focussing the image a conventional bellows and rack and inion arrangement is used, and the bellows extension is enerous—more than twice the focal length of the normal lens sed—so that lantern slides or prints can be made by reduc- on. The lens is fitted in a wooden panel which can be raised, wered, and moved from side to side, so that the image on e easel can be moved about as desired. When the illuminant sed is a compact filament lamp with no diffuser the use of

the rising, falling, or cross front means altering the position of the lamp so that it is no longer centred with the condenser. This need does not exist when using a diffused source.

The enlarger shown takes negatives up to half-plate and has a condenser $8\frac{1}{2}$ inches in diameter. The negative carrier has a series of holders so that smaller negatives can be enlarged. Although such an enlarger may be sneered at by the modern photographer brought up on a diet of streamlining and satin-chrome finish it will do work every bit as good as that produced by a modern enlarger. It is often possible to buy one second-hand at a reasonable price and the only component likely to fall below modern standards is the lens. If this is a really old one its performance may not be good and it will have to be replaced by a better lens.

The Enlarger Easel

The enlarger easel for a horizontal enlarger is usually a separate component, although in the case of Fig. 14 it is a fixture at the end of wooden rails on which the enlarger slides. It is a stout, cork-faced board to which the printing paper can be readily attached by means of dark-room pins. Some easels are quite elaborate affairs with rotating, tilting, and raising and lowering movements, and provision for holding the paper flat and in any desired position behind glass. The latter is effective but may give rise to defects in an enlargement because of dust and dirt or scratches on the surfaces.

Vertical Enlargers

The horizontal enlarger has largely given place to the vertical pattern with the coming of smaller negative sizes. The vertical enlarger has two big advantages over the horizontal: it is far more compact—generally essential in the amateur's dark-room—and the image being projected on a horizontal easel, it is easier to focus and inspect. The printing paper can be held in place by means of a weighted frame plus the help of gravity, doing away with the need for dark-room pins.

Against these advantages must be set some disadvantages. Vibration can be troublesome ; the enlarger being supported on a vertical column can quiver and give rise to blurred

ictures unless the enlarger is very solidly constructed. There a limit imposed on the maximum size of enlargement that an be made because of the finite length of the column. This an be overcome with some enlargers by swinging the lamp-ouse assembly clear of the baseboard and projecting on to he floor.

hoosing an Enlarger

here are many vertical enlargers from which the photogra-her can choose ; some are excellent, many are poor, and a ew are bad. In choosing one, an experienced friend can be of reat help, and the following list gives some of the more mportant points to watch for:—

(1) See that the whole enlarger is strongly built and that ven with the lamphouse at the top of its column there is no ndue tendency for the whole equipment to quiver.

(2) Make sure that the lamphouse is well ventilated but at he same time, light-tight, and that it can, if necessary, ccommodate at least a 100 watt lamp.

(3) Check that the up and down movement on the column smooth and positive, and that there is no tendency to slip.

(4) The negative carrier must be ' get-at-able ' and readily leaned. Also, if it is one of the glassless types for film nega-ives it must hold the film tightly along all edges.

(5) See that the focussing mechanism works smoothly, is ree from backlash, and that the lens panel is rigid.

Before buying an enlarger get the dealer to let you make a rint with it, or have it on approval with this fact stated on he bill. If he refuses, go somewhere else. Only in the dark-oom can you make sure that the illumination on the easel is ven. If it is markedly uneven and cannot be corrected by djusting the position of the lamp—if adjustment is provided—hen the enlarger is badly designed or constructed and is not orth buying. Quite naturally, the higher the price of an nlarger, the better it is likely to perform, but there is no eason why a simple, cheap enlarger should not work well. efinements such as automatic focussing are, of course, ex-

pensive, so do not expect too much if the price it is proposed to pay is a modest one.

Automatic Focussing

With an automatic focussing enlarger the lens-to-negative distance is altered by the action of moving the enlarger up and down its column, so that the image on the easel is always sharp. This is a great convenience, especially to the busy professional whose time is money. It is essential however, that the automatic focussing mechanism—usually a lever, roller, and cam-plate arrangement—shall be well made and free from error throughout the range of degrees of enlargement provided. A good manually focussed enlarger is infinitely better than a shoddy one with automatic focussing that is continually going wrong.

Automatic focussing is not free from disadvantages. Interchangeable lenses cannot be used as the profile of the cam-plate is cut for a lens of one particular focal length. Furthermore it is not always possible to change the lens for another of the same nominal focal length as the focal length engraved on most lenses is only approximately correct. The range of enlargement possible is usually fairly restricted because of the limitations imposed by the automatic focussing mechanism.

Fine Focussing

Sometimes an automatic focussing enlarger is fitted with a small manual lens movement which can be used for really critical focussing or where it is necessary to place the printing paper in a plane other than the usual one it occupies. For example, a masking board and paper holder may be used for small prints and discarded for large prints, and the thickness of the board will naturally upset the automatic focussing. With some enlargers the automatic mechanism can be thrown out of action if its use is impracticable for any reason.

Construction of Vertical Enlarger

In Fig. 15 is shown a side view of a typical vertical enlarger with manual focussing, and designed to take negatives up to $3\frac{1}{2}$ x $2\frac{1}{4}$ inches. The arrangement of the various

parts is essentially the same as for the horizontal enlarger except that the whole assembly is disposed vertically instead of horizontally. The position of the lamp can be adjusted so as to give even illumination of the image and the lamphouse

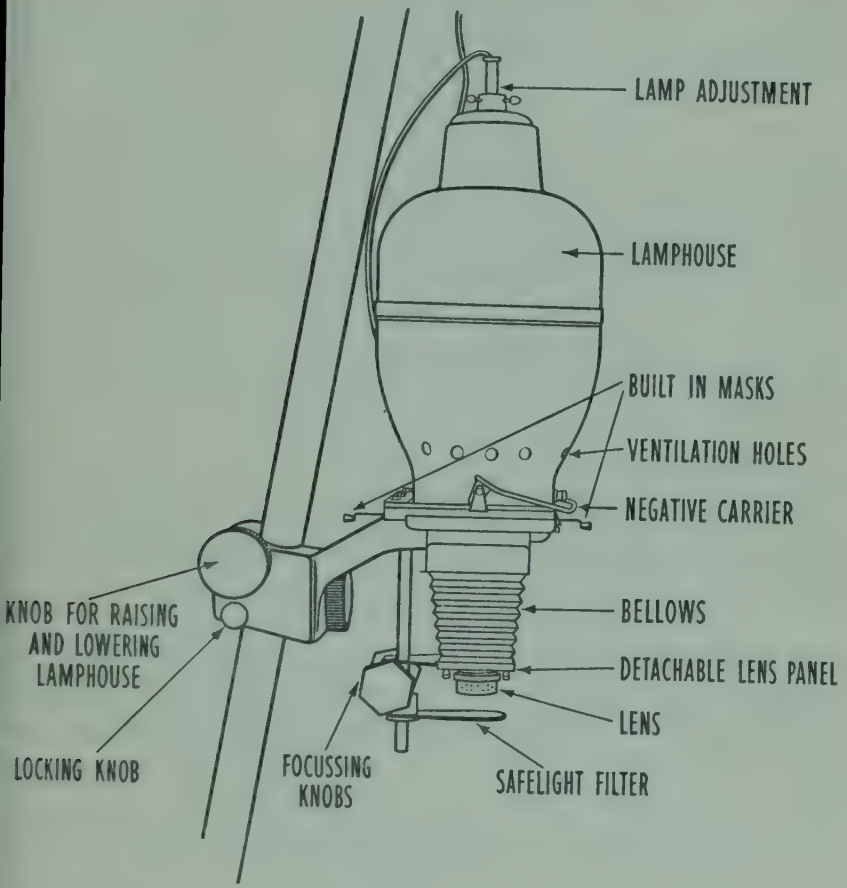


Fig. 15

Showing arrangement of the various parts of a modern vertical enlarger.

itself is of generous size and is well ventilated. The carrier takes film negatives which are held between two glasses to keep them perfectly flat. A special carrier is available as an accessory to take 35 mm. negatives, and this is glassless.

The enlarger shown has an adjustable mask so that unwanted light passing through or around the edges of the negative can be prevented from reaching the lens—a useful feature as it reduces the amount of flare light. Focussing is carried out by means of bellows and a rack and pinion mechanism. Notice the large focussing knobs, easily found in the dark-room and suitable for both right-and left-handed operators. An orange safelight filter is located in such a position that it can be swung in front of the lens while the printing paper is being placed in position on the easel.

Up and down movement of the enlarger is friction driven and again the knob is of generous size for easy operation. The drive can be securely locked when the image has been focussed as a precaution against inadvertent movement. The column itself is of large diameter which is an aid to rigidity. The baseboard is heavily constructed of wood, and besides serving as the easel, forms the support for the column.

Masking Boards

One of the great conveniences of a vertical enlarger is the ease with which printing paper can be held in place on the easel. To do this most effectively a masking board can be used of which there are many patterns on the market. It consists of a hinged adjustable mask which enables every print to be given a neat white border and at the same time holds the paper down along each of its four edges, ensuring flatness without the aid of pins.

Chapter 2

PRINTING PAPERS FOR ENLARGING

As a fast paper is necessary for enlarging, only bromide and fast chlorobromide papers are generally suitable. Given a powerful light source, a thin negative, and a moderate degree of enlargement, however, it is possible to use chloride paper without having to give unduly long exposure times. It used to be possible to obtain chloride papers of higher speed than is used for contact printing, thus making the qualities of chloride paper available for enlargements. This type of fast chloride paper may appear on the market again. The main advantages of chloride paper over other development papers are the slightly deeper black it gives and the rather better gradation in the lighter tones. Prints on chloride paper have a brilliance and sparkle which cannot readily be obtained on any other material.

The majority of enlargements are made on bromide paper which is about 100 times faster than the chloride paper used for contact printing. Bromide paper gives a neutral black image as against the slightly blue-black image of chloride prints and the warm tones of chlorobromide papers. The black tones of a bromide print can be converted to almost any colour by subsequent toning.

Paper Surfaces

Bromide papers are available with a wide variety of surfaces ranging from glossy to rough and the photographer can choose the one he considers most suitable for the picture being made. Glossy paper is practically essential for prints destined for reproduction by the printer or for any subject of which the keynote is brilliance and sparkle. Rough papers are best used

only for very large prints which depend for their appeal on tone masses rather than on the rendering of fine detail. A rough surface is useful as it tends to hide graininess in big enlargements from miniature negatives.

Between the two extremes of glossy and rough papers is a wide range of intermediate surfaces such as ' Velvet ', ' Half-grained matt ', ' Smooth matt ' and so forth. These are suitable for general use by the amateur and professional, and choice is largely a matter of personal taste. A similar but more restricted choice is available as regards the colour of the paper base. White is the normal colour but ivory and cream papers are suitable for pictures in which it is wished to suggest warmth. A snow-scene or a seascape looks peculiar on a cream paper but a portrait may look very effective. These points are more a matter of artistic consideration than technical, and no hard and fast rules can be laid down.

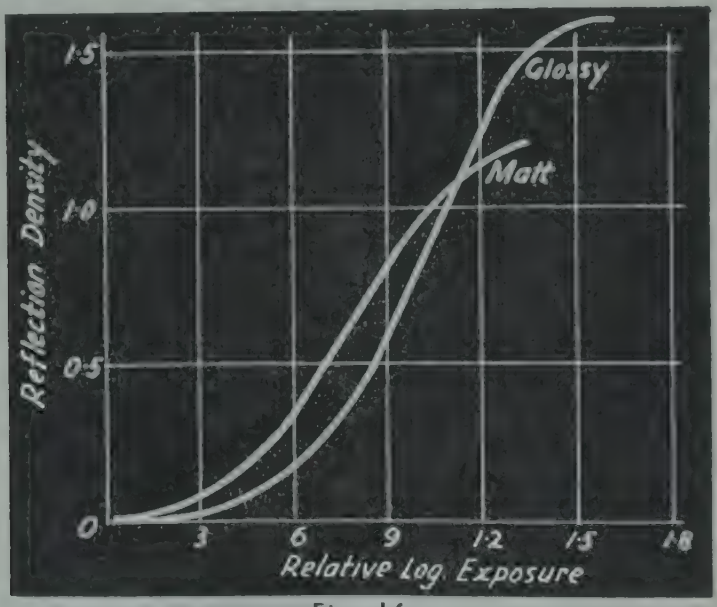


Fig. 16

Of these two characteristic curves, one is for glossy paper and the other for smooth matt. The difference in the density of the maximum black can be plainly seen, and this accounts for the inevitable flat ***appearance of a matt print.***

Paper Surface and Print Contrast

One point regarding paper surface must be borne in mind; that is, its influence on the contrast shown by the print. If, from the same negative we make three prints, one on glossy, one on velvet, and the third on smooth matt paper, aiming to produce identical prints, we shall find that while they are wet there may be little or no difference between them. After drying however, they look very different. Of the three, the glossy print—especially if glazed—has rich blacks and high contrast; the smooth matt print has blacks which are very much lighter in tone and consequently is lower in contrast, while the velvet print is intermediate in its depth of black and in contrast also.

Subject Contrast

Subjects of high contrast should not be printed on smooth matt paper if they are to be reproduced with any truthfulness, and conversely, it is probably better not to choose a glossy paper for a soft subject such as a misty landscape, although it is possible to reproduce a short brightness scale on glossy paper whereas it is not possible to show a long brightness scale on matt paper. The maximum black given by a matt can be darkened by 'doping' with a suitable varnish made for the purpose, but this introduces a sheen which destroys the dead matt appearance.

It is important to bear in mind the connection between paper surface and the maximum black it is possible to secure. It has nothing to do with the contrast *grade* of the paper; a glossy paper will give a certain maximum black regardless of its contrast grade, and a matt paper will give a poor maximum black whether it be soft, normal, or hard.

Paper Grades

Printing papers are made in various contrast grades to suit negatives of different contrasts, and it is essential to understand how differences in contrast grade affect practical enlarging. If we take a sheet of what is called 'soft' paper and in the dark-room give it a wide range of known exposures from too little to give any silver deposit at all to far more than

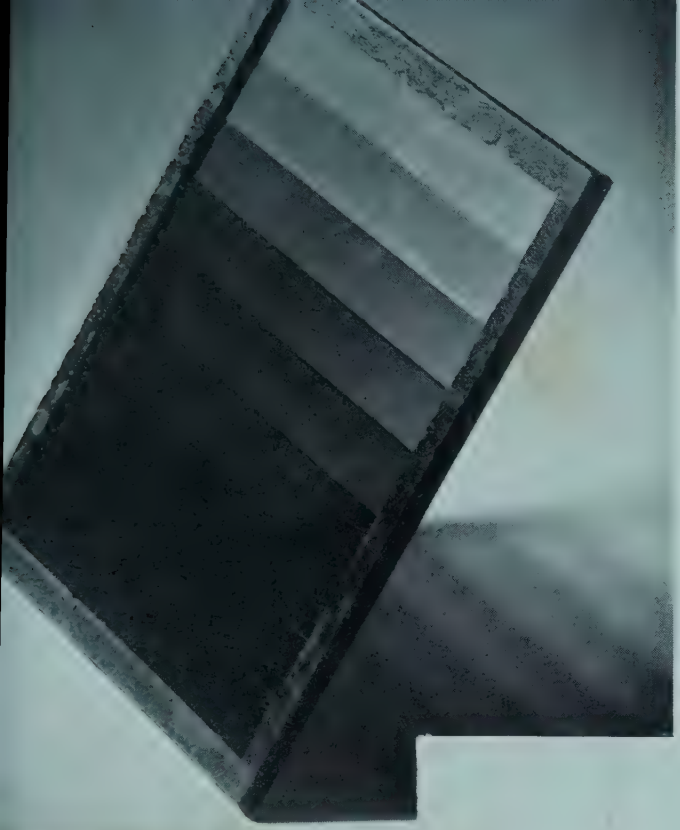
is needed to produce a full black, we shall find that it may require about 30 times as much exposure to produce just a full black as it does to produce a tone just distinguishable from white. This ratio—30 to 1—is known as the exposure scale of the paper, and a negative to suit such a paper must have an opacity range of approximately 30 to 1, that is, the deepest shadow should transmit 30 times as much light as the densest highlight.

Total and Useful Exposure Scales

In computing the exposure scale of a paper on the basis of the experiment described in the previous paragraph, we are calculating the ratio between two exposures; the one needed to give a pale grey tone only just discernible against the white paper and the other required to give just a full black. The exposure scale found in this way is the *total* exposure scale of the paper, and in practice we cannot make use of all of it. The *useful* exposure scale is rather less than the total exposure scale and can be considered provisionally as being the ratio between the exposure needed to give a pale grey readily distinguishable from white paper and the exposure needed to produce a tone a little removed from the deepest black the paper can give. This is a very rough and ready definition but the only one that can be offered without going deeply into the sensitometry of printing papers. In practice, the agreement between the opacity range of the negative and the exposure scale of the paper does not have to be close.

Soft, Normal and Hard Papers

A soft paper has a long exposure scale, and a hard paper a short exposure scale, while a normal paper has a scale between the two. It is difficult to give precise figures for the different grades available as there is no general agreement between manufacturers as to the useful exposure scales of soft, normal, and hard papers. The following table gives the approximate useful exposure scales for several popular makes of bromide papers. In the last column is given the exposure scale expressed logarithmically. As will be seen later, it is sometimes useful to know this.

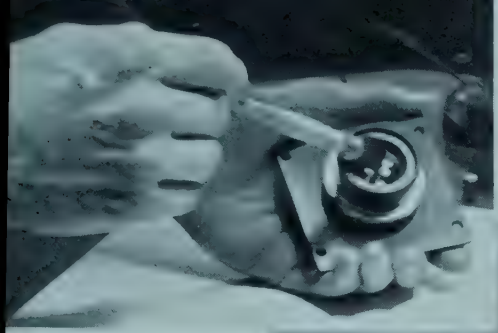


CALIBRATED STEP-WEDGE

A calibrated step-wedge such as can be used for determining the useful exposure scales of printing papers. This wedge has nine steps and the density difference between two adjacent steps is 0′3, representing an exposure ratio of 2.

Wedge exposures of soft, normal, and hard glossy bromide papers. Such tests are useful for determining the useful exposure scales and relative speeds of different papers. The black and white crosses indicate the first clearly discernible grey tone and the tone just removed from full black.

Above: These two prints received 2 and 10 seconds exposure respectively, and we developed by inspection for periods of 1¼ minutes and 10 minutes. As can be see there is practically no difference between them, which shows the big latitude in expo sure and the interdependence of exposure and development. *Below*: While adequa time in the fixing bath is essential if prints are to be permanent, too long a tim causes bleaching of the lighter tones of the picture. These two prints receive exactly the same exposure and development, but one was fixed for more than a hour and was allowed to float face upwards in the bath.



A soft brush and some lens-cleaning tissues, used regularly on the enlarger lens ensures enlargements that are not degraded through excessive lens flare.

ratched film nega-
can be sandwiched
glycerine between
clean glasses and it
be found that the
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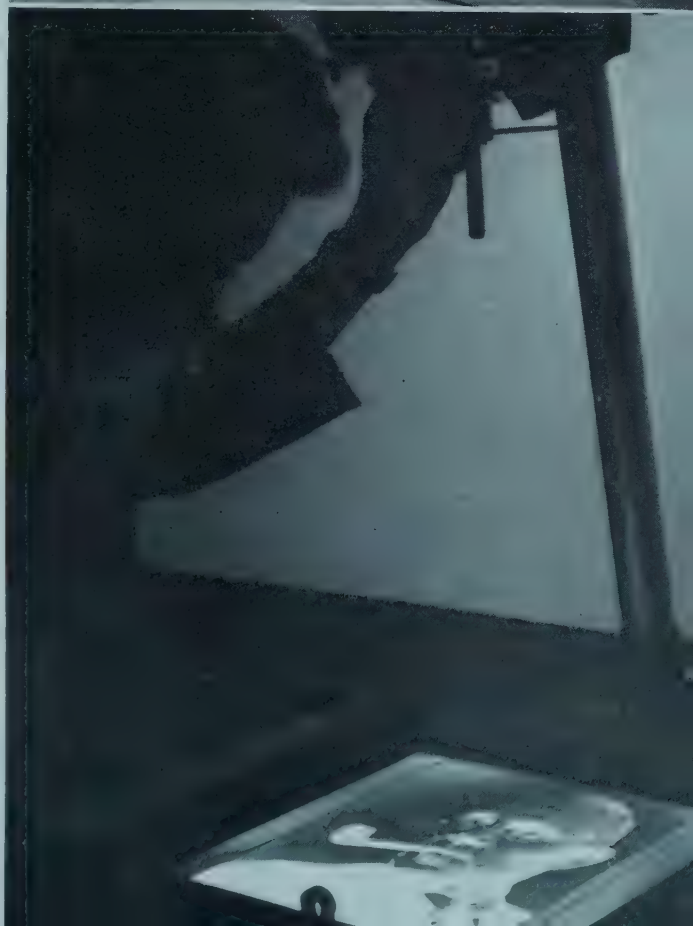

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EXPOSURE SCALES OF TYPICAL BROMIDE AND FAST CHLOROBROMIDE PAPERS

PAPER	APPROXIMATE EXPOSURE SCALE	LOG EXPOSURE SCALE
KODAK BROMESKO		
Soft (1)	20 – 1	1.29
Normal (2)	11 – 1	1.04
Hard (3)	7 – 1	0.83
KODAK BROMIDE		
Soft (1)	20 – 1	1.3
Normal (2)	10 – 1	1.0
Hard (3)	5 – 1	0.69
ILFORD PLASTIKA		
Soft (1)	18 – 1	1.25
Normal (2)	9 – 1	0.95
Hard (3)	7 – 1	0.85
ILFORD BROMIDE		
Soft (1)	25 – 1	1.40
Normal (2)	15 – 1	1.10
Hard (3)	10 – 1	1.0

All papers in above table developed for 2 minutes at 65° F. in D.163, diluted 1 to 3.

Contrast Grade Numbers

Although there is no real agreement between the exposure scales of different makes of paper of the same grade, the naming and numbering of the grades has been generally

PAPER GRADE NAMES AND NUMBERS

NAME	NUMBER
Extra Soft	0
Soft	1
Normal	2
Hard	3
Extra Hard	4
Ultra Hard	5

agreed on. The grades are numbered from 0 to 5 and paper can safely be ordered by number only. The above table gives the numbers and names of the contrast grades.

Bromide papers are generally available in grades 1, 2, 3 and 4, and "fancy" surfaces in grades 1, 2 and 3. Only chloride papers are generally available in all six grades and specialised papers are often only made in one grade—normal.

Matching Paper to the Negative

The agreement necessary between the useful exposure scale of the paper and opacity range of the negative is not a close one, but for good prints it is essential that the paper and the negative should be matched approximately. A print on a paper too soft for the negative will have no good black anywhere, and the highlights will probably be too dark. On the other hand, a print on a paper which is too hard for the negative will have black shadows with little or no detail and possibly chalky white highlights. The good gradation from full black to white paper with detail in both highlights and shadows is only secured on a grade of paper appropriate to the opacity range of the negative.

Modifying the Exposure Scale

The exposure scale of a paper is a more or less fixed quantity and it cannot be made markedly smaller—that is, the contrast increased—by prolonged development nor greatly increased—that is, contrast reduced—by curtailing development. It is possible, however, to alter the contrast of a bromide paper a little by using a caustic hydroquinone developer to decrease the exposure scale or a plain metol developer to increase it. These are makeshift means which are useful when the correct grade of paper for a particular negative is not available, but the alteration in contrast secured by these means is very small and therefore rarely worthwhile.

Simple Sensitometry

The precise behaviour of a printing paper can be shown best by means of its characteristic curve, a typical one of which is shown in Fig. 17. For the benefit of readers whose knowledge of sensitometry is slight, a few words of explanation as to how such a curve is made may be offered. A sheet of the paper is

xposed behind a step-wedge, the density of each step of which is known. A wedge in which each step transmits exactly wice as much light as the next denser one is the most con- enient for the purpose. The exposure given is not important provided that upon development the paper shows a full range of tones from white to full black.

Using a wedge such as has been described, the sheet of paper receives a series of relative exposures of 1, 2, 4, 8, 16, 32, 64, 128, and so forth, the range of exposures depending on the number of steps in the wedge. If the reflection density of each step of the test strip is measured and plotted against the logarithm of the relative exposure that produced that particular density we get the characteristic curve of the paper. More

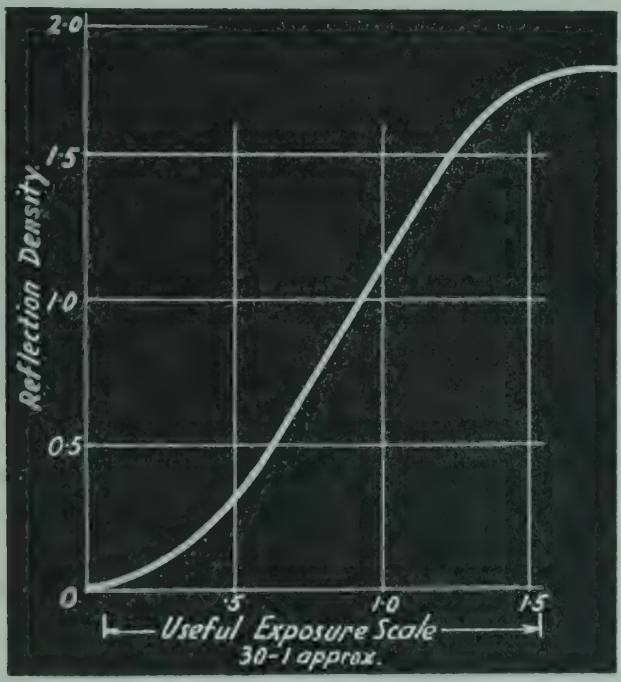


Fig. 17

This is the characteristic curve of a glossy bromide paper. From it can be determined the maximum black the paper can give and also its approximate useful exposure scale which can be regarded as lying between the limits indicated.

directly the densities of the test strip can be plotted against the densities of the calibrated wedge.

Information from the Curve

What can such a characteristic curve tell us? We can see at once the maximum black the paper can give, which in the case of Fig. 17 is 1.80. This means that it must be a glossy paper, for no other surface gives such a high density. From the log. exposure axis we can find the useful exposure scale of the paper. This lies roughly between the points shown and represents a logarithmic range of 1.5. This is an actual range of about 30 to 1, indicating a soft grade of paper.

At this point it is necessary to explain the significance of the shape of the characteristic curve. The extreme bottom of the curve, as can be seen, is horizontal and then suddenly it begins to run uphill with rapidly increasing gradient to the portion which is practically straight where the gradient is constant. Then at the top of the straight portion the slope decreases rapidly until it becomes zero again. Where the curve is straight—overlooking the contradiction of terms—equal multiples of exposure result in equal additions of density —the ideal response which unfortunately does not hold good over the whole exposure scale of the paper.

"Toe" and "Shoulder" of the Curve

On the ' toe ' and ' shoulder ' as the bottom and top of the curve are called, equal multiples of exposure do *not* result in equal density increases. In fact, where the curve is horizontal, increasing exposure gives no increase of density at all. Now it is easy to understand that in order to obtain good separation of tones in a print the curve of the printing paper must have more than a certain gradient ; if the gradient is insufficient, tones which should be reproduced as distinctly different densities will be too much alike.

In practical printing of a normal subject, the highlights fall on the toe of the paper curve and the shadows on the shoulder. If we want a pure white and a full black in the photograph, and we nearly always do, these regions of the curve cannot be avoided. The result is, that however perfect

ur negative we inevitably have flattened gradation in the ighlights and shadows of the print. However good our print cannot be as good as the negative from which it is made. he half-tones can be reproduced satisfactorily; it is the nadows and the all-important highlights that suffer from ompression. This is one of the limitations of the photographic rocess which cannot be overcome. In understanding that it oes exist we can minimise it by resorting to a little trickery pon occasions.

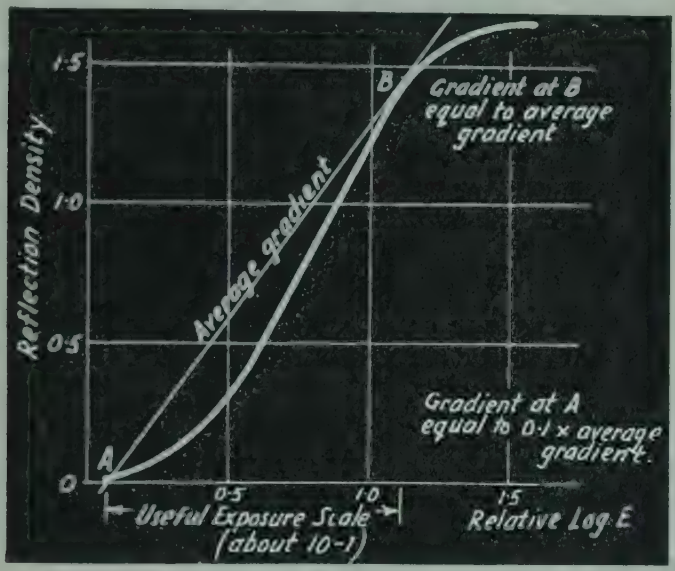


Fig. 17*a*

howing a method, now a recognized standard, for determining the oints on a paper curve between which lies the useful exposure scale.

Determining the Exposure Scale

n deducing the useful exposure scale from the characteristic urve it has to be decided how much of the curve is usable n printing. In other words, at what point on the toe of the urve is the gradient sufficient to give acceptable separation of ighlight tones, and where on the shoulder of the curve does he gradient become insufficient to give enough differentiation etween the shadow tones of the picture? The two points on he curve between which the useful exposure scale of the paper

extends are not easy to define precisely but this need not worry the photographer as long as he remembers that the useful exposure scale of a paper is a little less than its total exposure scale.

The reader who is interested in the relationship between the exposure scale of a printing paper and the density range of the negative can do no better than refer to the very fine paper, ' The Control of Photographic Printing by Measured Characteristics of the Negative ' by L. A. Jones and C. N. Nelson, published in the Journal of the Optical Society of America (558-619) 1942 and reprinted in the 1942 issue of ' Abridged Scientific Publications from the Kodak Research Laboratories ', Communication No. 874. In spite of its rather forbidding title this paper explains very clearly the fundamentals of printing.

We have the situation that in buying printing paper we can ask for a particular contrast grade by name or number without the assurance that it will have a particular exposure scale. Papers by different makers vary in this respect; the soft grade of one make may have the same exposure scale as the normal grade of another make and so forth. This is a good reason for using the paper by one maker only so that it is possible to become thoroughly familiar with the contrast of each grade. It may well be that paper manufacturers will one day print on each packet of paper the approximate exposure scale of the contents.

Using a Step Wedge

The photographer who is keen to know as much as possible about the bromide papers he uses can discover a great deal by the use of a calibrated step-wedge. One suitable for testing papers can be obtained by special order from either Ilford Ltd. or Kodak Ltd. The wedge should have about ten steps each about 1 cm. wide and the density difference between any two adjacent steps should be 0.3. The M.C.M. Step-wedge made by Ilford is satisfactory for the purpose. A sheet of printing paper exposed behind such a wedge will receive a

ries of relative exposures—1, 2, 4, 8, 16, and so on, as escribed previously.

To use a calibrated wedge is a simple business. Assume that e have a soft, normal, and hard paper and wish to know he approximate exposure scale and the relative speed of ach. Place the wedge in a printing frame and place in contact ith it a narrow strip—say about $\frac{1}{2}$ inch wide—of each paper. xpose the frame to the undiffused light from a 60 watt lamp or a time sufficient to give a pure white and a full black on ach strip. This time will have to be found by experiment, but seconds, 3 feet from the lamp should be about right.

The three strips should be developed in the same developer hat the photographer proposes to use for the paper in normal rinting, and for the same time and at the same temperature. fter fixing, washing, and drying they will appear something ke the test strips reproduced on page 43. To find the approxiate exposure scales of the three grades, count the number of teps from the first pale grey tone to the first very nearly full lack in each case. The exposure scales can then be found rom the simple formula:—

$$E.S. = 2^{(n-1)}$$

here n is the number of steps. Thus if the number of steps is , then the exposure scale is $2^5 = 32$ to 1.

In the test strips on page 43 the first grey tone and the first ery nearly full black tone are marked with a black cross and white cross respectively and the approximate useful exposure cales work out as follows:—soft 16-1, normal 8-1, and hard -1. So that the figures obtained in this way do represent the seful exposure scale rather than the total exposure scale, the ery faintest grey tone that can only just be detected by comarison with the white paper should be ignored. And instead f taking the first full black, the tone that is just removed rom black only should be considered.

elative Speeds of Papers

he test strips produced for the determination of exposure cales can be used for finding the relative speeds of the three rades provided, of course, that they were exposed together

as described. With the strips lined up as they were in the printing frame, see how many steps separate the faintest discernible tone on each. Each step represents a halving or doubling of the speed. It will be seen by referring again to the test strip that the soft grade is the fastest paper, normal about one quarter the speed of soft, and hard, rather more than half the speed of normal. These relative speeds will apply in practice if the photographer is aiming at equal highlight densities in a series of prints from different negatives. On the basis of equal densities in the shadows or in a middle tone, relative speeds will be different as can be seen by studying the strips. In passing, it may be mentioned that it is convenient to number the steps of a calibrated wedge with liquid opaque such as is used for blocking out negatives, used with a brush.

Developing Bromide Papers

The development of bromide papers presents no difficulties and it can be reduced to a straightforward routine. It is a logical plan to use the developer recommended by the makers of the paper being used, but Kodak D163, the formula for which is given on page 79 will be found to work very well with any make of paper.

The temperature of the working bath of the developer should be maintained at between 65° and 70° F. If the authors were asked to suggest the most common cause of poor quality prints the answer would be, ' cold developer ' While no great difficulties arise if the temperature of the developer is up to 75° F. or even a little higher, at temperatures of 60° F. and below, prints lack the rich blacks which are a hallmark of a good print. Hydroquinone, one of the developing agents, loses much of its activity at low temperatures and leaves the metol to do all the work. And metol does not readily give a good black even if development is greatly prolonged.

Maintaining Developer Temperatures

It is the amateur photographer, working perhaps in an attic or cellar, who is most likely to be troubled by falling tempera

ures in cold weather. A few fluid ounces of developer in a ish will soon adopt the temperature of the surrounding air nless steps are taken to keep the solution warm. A simple nethod of doing this is to stand the dish in a larger one

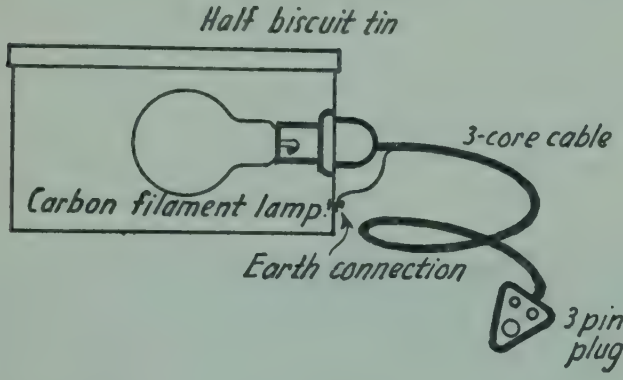


Fig. 18

A simple dish-warmer made from a half biscuit tin in which is fixed a carbon filament lamp. For the sake of safety it is essential that the tin should be efficiently earthed by using a three-core cable in conjunction with a three-pin plug.

containing warm water. A thermometer clipped in the corner of the developing dish will indicate when the temperature is rising above 65° F. and the dish can then be removed from its water bath temporarily. This is a messy and rather laborious business and a proper dish warmer is worth buying or making.

An efficient dish warmer can be made from a half biscuit tin as shown in Fig. 18. A lampholder is fixed in a hole cut in one side of the tin and a carbon filament lamp inserted. The heat from the latter will be found sufficient to maintain the temperature of a dish of developer at the required level even in a really cold room. Once more a thermometer must be kept in the developer to keep a constant check on the temperature but the gentle heat from the lamp will not cause a rapid rise. Although a carbon filament lamp is specified as the source of heat, a 40 watt gas-filled lamp can be used, but it is rather less efficient as a radiator of heat.

Safety First

Any electrical device like the dish-warmer described should be wired with three-core rubber covered cable and connected to a three-pin plug, making sure that the earth wire is securely connected to the biscuit tin. This is an essential precaution against severe electric shock should the live wire touch the metal.

Development Time and Contrast

It is well-known that in the development of negative materials, contrast increases with prolonged development until the maximum contrast is reached that the material can give before the

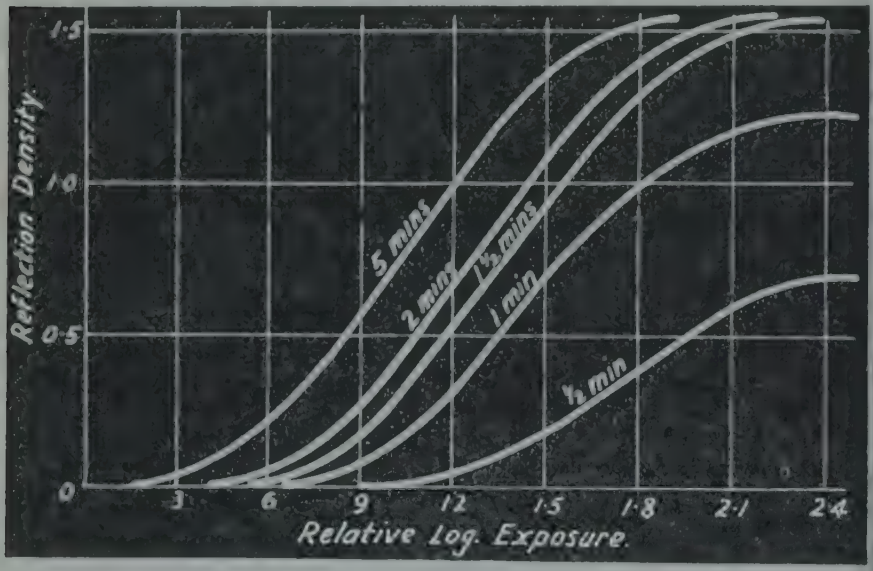


Fig. 18

A family of characteristic curves of the same bromide paper but for different times of development. Notice that a time of about 1½ minutes gives the maximum contrast of which the paper is capable. Development times longer than this merely result in slight increase in the effective speed of the paper.

onset of serious fogging. In negative processing development is normally arrested long before this point is reached. When developing bromide paper this is not so ; we develop to the

maximum contrast the paper can give, and this does not take very long. In Fig. 19 are reproduced several curves of a bromide paper, each one representing a different time of development. Notice how after about 1½ minutes the curve reaches an equilibrium shape and how longer times up to about 5 minutes merely cause the curve to move a little to the left. There is a very slight increase in the slope of the curve with development times longer than 1 minute but it is only slight, and there is practically no increase in the maximum black—1.55 in this case—and therefore contrast increases only by a negligible amount. The result of increasing development is merely to increase the *effective speed* of the paper.

The foregoing paragraph is highly important for it gives a fact not always appreciated. If we make a test exposure on bromide paper and develop it for say 2 minutes, then any print exposed on the basis of this test must also receive a development time of 2 minutes under the same conditions of temperature, and developer exhaustion. More development will result in a print that is too dark; shorter development in a print that is too light.

A bromide paper can be developed for any time between about 1½ minutes and 4 minutes, and provided a suitable exposure has been given, a satisfactory print will result. Less than 1½ minutes' development will give prints with blacks less dense than the paper can produce, and they are likely to have an unpleasant greenish tone. Development for longer than about 4 minutes may cause fog and yellow stains although modern papers can withstand forced development very well.

4 *Standard Development Time*

To avoid the evils of under-development and the risks of excessive development it is usual and convenient to adopt a median development time of 2 minutes. This is fairly arbitrary; 2½ or 3 minutes would do just as well. If 2 minutes is adopted as a standard and adhered to rigidly for test exposures and is timed accurately with a clock it is permissible to decrease it to about 1½ minutes for a print that has been over-exposed accidentally, or to prolong it to the

maximum of 4 minutes for inadvertent under-exposure. The aim should always be, however, to expose so that with 2 minutes development a print of suitable depth results, and the facility of varying development times to correct small exposure errors regarded as an insurance to be drawn on only in emergency.

Developer Improvers

Certain organic compounds added in small quantities to a bromide paper developer have some very useful effects. First they tend to give a blue-black image instead of a neutral black and should a print be snatched from the developer after only 40 seconds or so they prevent the unpleasant greenish tones which normally ruin an under-developed print. At the other end of the scale they help to prevent fog and stains if development is really forced. Stale paper which shows fog even with a normal development time can be used successfully if one of these developer improvers is used. They really do work and are obtainable under various proprietory names in solution form with full instructions for use.

Stop Baths

After development a print should be rinsed thoroughly in clean water to remove as much developer as possible before placing it in the fixing bath. Better still, a stop bath of 1 per cent acetic acid made by adding 1 ounce of glacial acetic acid to 5 pints of water, can be used. This immediately neutralises the alkali in the developer retained by the print and stops its action immediately. A stop bath has several advantages over a plain water rinse:—

(1) Development is arrested at once,

(2) Risk of stains is reduced,

(3) The effective life of the fixing bath is prolonged,

(4) When developing a number of prints at the same time they can be left in the stop bath until the last one is out of the developer, a procedure which saves contaminating the fingers with hypo while developing.

Prints should be immersed in the stop bath and agitated for at least 5 seconds, and while it is permissible to leave them

Kodak Precision enlarger (Model 2). A well-designed enlarger suitable for both amateur and professional use. Takes negatives up to $3\frac{1}{2} \times 2\frac{1}{2}$ inches.

ENLARGERS

The Johnson V8 enlarger for negatives up to $2\frac{1}{4} \times 3\frac{1}{4}$ inches. Gives up to 6 diameters enlargement on the baseboard.

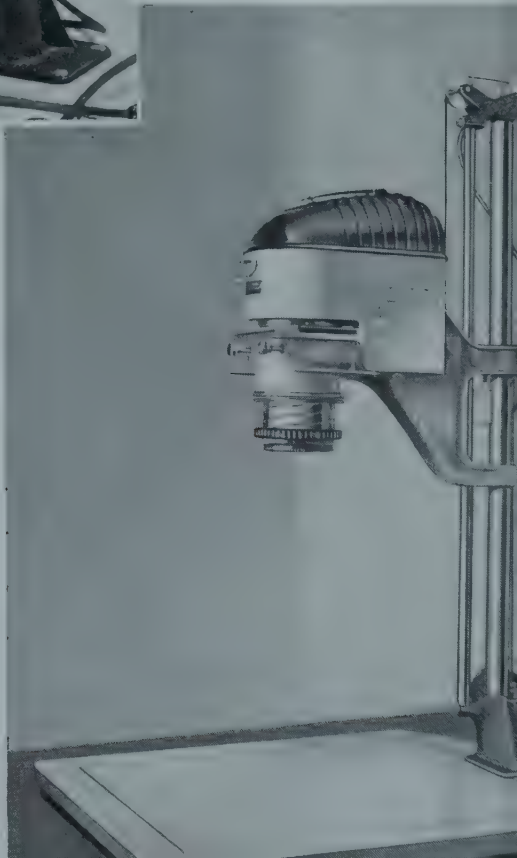
The Gnome Universal Alpha enlarger taking negatives from 35 mm. to $2\frac{1}{4} \times 3\frac{1}{4}$ inches. A model is available with a rangefinder mechanism built in.

ENLARGERS

A modern enlarger for large negatives and fitted with automatic focussing. This is the Kodak Specialist and embodies the experience of many years in the design of enlargers. *Photograph by Kodak Ltd.*

A compact portable enlarger for 35 mm. negatives. An instrument of this kind is thoroughly efficient and is invaluable to the traveller and also to the amateur who has not sufficient room at home for a permanent darkroom. *Photograph by Ilford Ltd.*

The "Durst 609" enlarger. This is an Italian instrument of unconventional appearance capable of taking negatives up to $3\frac{1}{2} \times 2\frac{1}{2}$ inches. It can be used as a slide projector and as a copying camera as well as an enlarger.



The Veigel enlarger, a German instrument of modern design. *Photograph by Neville Brown & Co. Ltd.*

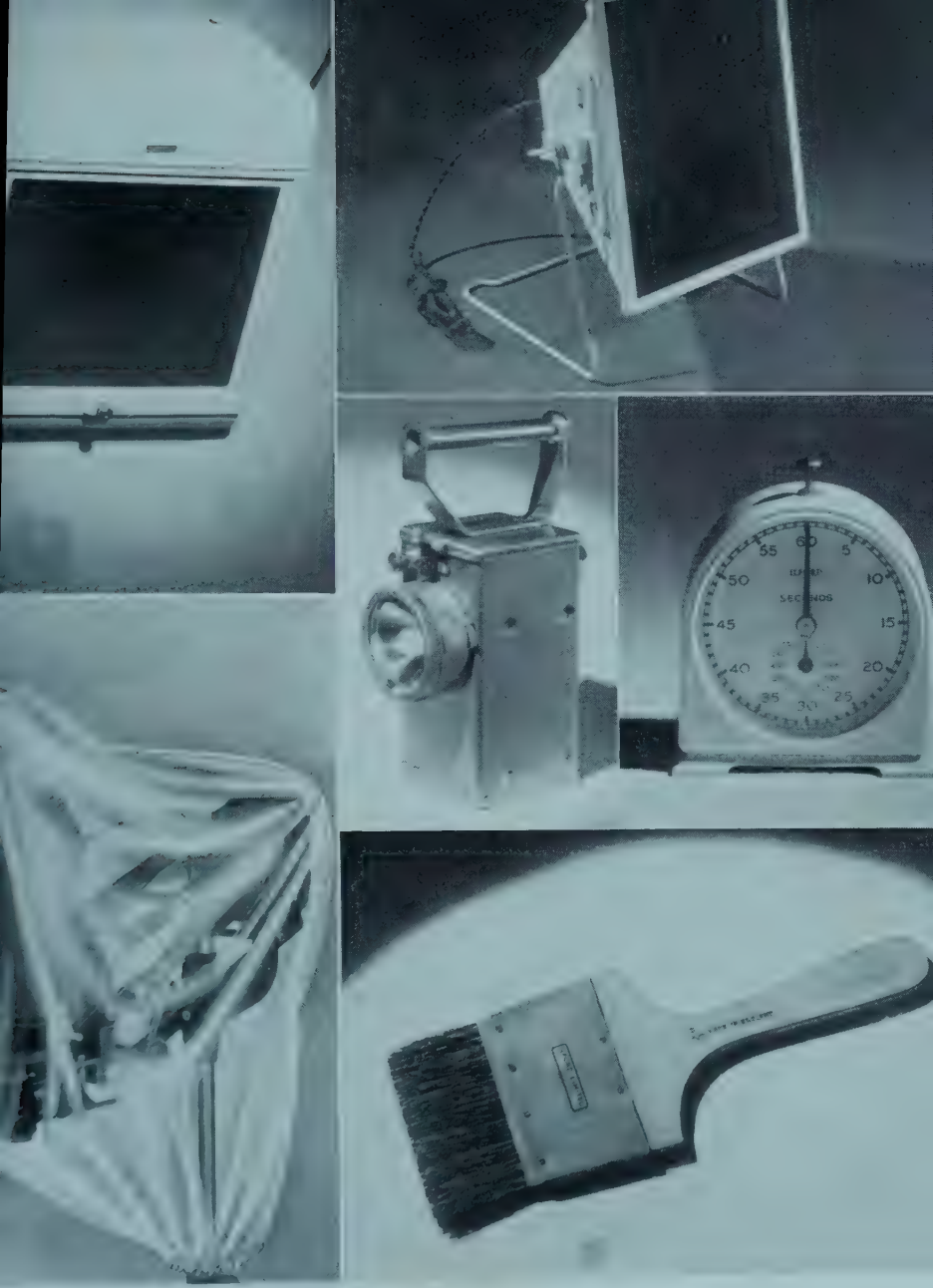
The M.C.M. photometer for the determination of exposure times in enlarging. This makes use of the grease spot principle and it measures the illumination of the image in its brightest part, i.e., in the deepest shadow tone. *Photograph by Neville Brown & Co. Ltd.*

USEFUL ACCESSORIES

e Hoer focussing mag-
er. This is one of
eral similar devices de-
ed to facilitate the
ssing of the image on
enlarging easel. An
ge is projected on to
all ground glass screen
this is viewed through
agnifier. *Photograph by*
lond and Aitchison Ltd.

e S.E.I. Exposure
tometer with its acces-
es to convert it for use
transmission densito-
er. This forms a valua-
e instrument with
ch enlarging exposures
be computed without
need for trial expo-

Top left: An Ilford adjustable enlarging paper holder keeps the printing paper perfectly flat and gives each enlargement a neat white border. *Centre left*: Ilford No. 2 print paddle. *Bottom left*: A Kodak flat bed print dryer and glazer with which the drying of enlargements can be done in a matter of minutes. *Top right*: An easily-read robust thermometer is an essential in every printing room. *Bottom right*: Dry prints being stripped from a stainless steel glazing sheet.

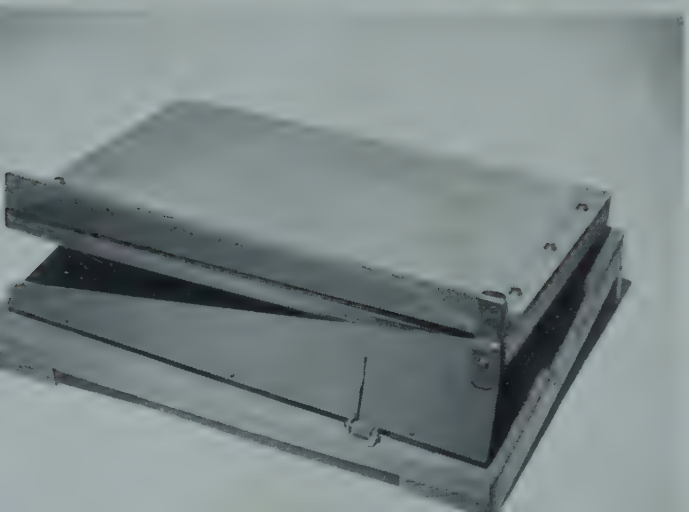


op left and top right: Two types of modern safelight lamps by Ilford, one r wall mounting and the other designed for standing on the bench. *ottom left*: An efficient dust cover is a sound investment for your en- rger. *Centre left*: Portable darkroom lamp. *Centre right*: An Ilford conds timer with bold figures which can easily be read even in poor ght. *Bottom right*: A soft dusting brush is excellent for removing dust om negatives and negative carrier pressure glasses.

USEFUL ACCESSORIES

A test strip holder lik this enables four tri exposures to be mad side by side on the sam piece of paper from th same portion of th image.

An electric dry-mount ing iron with thermo static control make light work of mountin even large prints. A slot in the body of th iron holds a small fixin iron which is always a the right temperatur for use.



A trimming desk de signed for the rapi and accurate trimmin of prints. To the bus professional somethin of this kind is essenti and even the amateu will find it useful if h does a lot of work.

Photographs by Ilfor Ltd.

n the bath until the development of a number of prints being rocessed together is complete, they should be transferred to he fixing bath as soon as possible. As a stop bath of dilute cetic acid is inexpensive it should be renewed frequently to nake sure that it is effective. A gallon of the bath will treat bout 50 whole plate prints or their equivalent.

Fixing Prints

Where an acid bath is employed it is quite permissible to use a plain solution of hypo for fixing, but to reduce the risk of tains to negligible proportions an acid fixing bath is better. The following is a typical one:—

Hypo (crystals)	5 oz.	250 gm.
(*or* anhydrous)	(3½oz.)	(160 gm.)
Potassium metabisulphite	½oz.	25 gm.
Water to make	20 oz.	1000 cc.

t should be noted that when using hypo crystals, hot water is equired if they are to dissolve quickly. The potassium meta-bisulphite should not be added until the solution is cool. Anhydrous hypo should be dissolved in cold water as it cakes nard in hot. One pint of the above fixing bath will deal effi-ciently with 10 whole-plate prints or their equivalent. If an cid stop bath is used, 15 whole-plate prints can be fixed in one pint.

The importance of thorough fixation cannot be over-emphasised. Insufficiently fixed prints can never be permanent; heir images turn yellow owing to the oxidation of residual ilver compounds to silver sulphide by the sulphur in he hypo. Permanence may not appear to be an important natter at the time an enlargement is made and for many photographs a long life may not be required. But pictures of friends and loved ones increase in value with the passing of he years and eventually become irreplaceable. It is worth aking the little trouble needed to ensure as long a life as possible. Thorough fixation is just as vital for the professional, who may quickly lose his reputation if his prints fade.

Prints should be plunged into the fixing bath and agitated for at least 10 seconds to ensure that the solution comes into contact with every part of the fronts and backs. A total fixing

time of from 10 to 15 minutes is sufficient, but prints should be kept face downwards in the bath and moved about from time to time. It is safe to inspect prints in white light after they have had 2 minutes in the fixer.

The use of two fixing baths is recommended as a guarantee of thorough fixing. After 5 minutes in the first bath, prints are transferred to a second, perfectly fresh solution for a further 5 minutes. The first bath is discarded after use, replaced by the second, and fresh solution used for the second bath.

Temperature of the Fixing Bath

At low temperatures a fixing bath works slowly, and while it may not be feasible to maintain the temperature at 65° F., it is desirable to keep it at 60° F. at least, otherwise fixation may not be complete in spite of all other precautions. If the fixing bath is really cold the time of fixing can be increased by 5 minutes just to be on the safe side.

A few 'don'ts' regarding fixation should be remembered:

(1) Never let prints bunch together in the bath ; move them about frequently.

(2) Don't let prints float face upwards in the fixer, as the emulsion may rise above the surface of the liquid.

(3) Never fix for too long. While a few minutes over and above the necessary 10 to 15 minutes will do no harm, prolonged immersion in a fresh acid fixing bath is likely to cause partial bleaching of delicate highlights and possibly slight yellowing through the silver being oxidised to silver sulphide. This is less likely with bromide papers than with chlorobromides, but it can happen.

(4) Remember that hypo is comparatively cheap and do not use a fixing bath that is exhausted.

(5) Do not use for prints a fixing bath that has previously been used for plates or films. The iodides from the negative material slow up fixing and may cause yellow stains.

Rapid Fixing

The professional photographer quite often has to produce

prints ready for the press with as little loss of time as possible and the amateur too may want to make an enlargement or two in a hurry. For an occasional print it is possible to save time in the fixing bath without loss of image permanence. It is not generally known that in a perfectly fresh fixing bath—and by perfectly fresh is meant a bath that has not had a single print through it—printing paper fixes completely in less than a minute. So by using a small quantity of fresh fixer for a print wanted quickly, many minutes can be saved. After the first print through the bath the fixing time lengthens rapidly so that it is essential to use new solution for every print.

For the photographer who needs speed often, there are extra-rapid fixing solutions in which prints fix in a minute or less right to the end of the life of the bath. 'Amfix' made by Messrs. May and Baker Ltd. is an example, and Messrs. Kodak Ltd. supply 'Quick-finish' chemicals which include a developer and a fixing bath. Such materials are rather more expensive than the normal chemicals employed but they are worthwhile when speed is essential.

The Washing of Prints

Thorough washing is complementary to adequate fixing. For a high degree of image permanence every trace of hypo and soluble silver salts must be removed from the emulsion and the paper of a print. Any such chemicals left in the print will, in time, cause the image to 'fade'. This process is greatly accelerated by warm humid conditions, so that photographers in hot climates have to be punctilious in these matters.

The average system of print washing is far from efficient, probably because it is not always realised how difficult it is to ensure complete elimination of hypo from prints. The fibres of the paper hold it very tenaciously and it is in fact impossible to remove every trace by washing alone. The traces of hypo left in the paper are not sufficient to cause rapid fading but when maximum permanence is wanted they have to be removed chemically.

Single-weight papers should be washed for 1 hour in running water and double-weight papers for 2 hours. In addition,

the system of washing must be such that prints do not cluster together so that free access of clean water to fronts and backs of prints becomes impossible. In a well designed washing tank, fine jets of water or some other arrangement, keep prints separate all the time and also produce the necessary turbulence of the water in the tank to replace hypo-contaminated water with fresh.

Temperature of the Washing Water

Photographic materials give up hypo more quickly in warm water than in cold, and ideally, the washing water should be maintained at a temperature of between 65° and 75° F. In temperate climates like that of Britain, water from the mains rarely attains temperatures within this range and then only in the height of summer. In winter the temperature will be down in the forties.

If at all possible, some means of warming the washing water should be found, or if this is not practicable, then the recommended washing times given earlier should be increased by 50 per cent. when the water is really cold, or even doubled if the pictures being washed are valuable.

Washing Prints by Hand

Although it is rather a tedious process, an efficient print washing system for the amateur is to use several changes of water. The fixed prints are placed one at a time in a large dish of clean water—preferably at not less than 65° F.—and moved about at intervals. At the end of 5 minutes the water is poured away, replaced by fresh, and the prints placed in it, again one at a time. Twelve changes are sufficient for single-weight paper, and twenty-four for double-weight. Using this method it is not an impossibility to maintain the temperature of the water around 75° F.

A large dish with a stream of water running into it is widely used for washing prints. It is efficient only if the prints are carefully separated at frequent intervals, and so long as the dish is not overcrowded. Also, the water should not be contaminated with hypo by introducing prints from the fixing bath.

Hypo Test Solution

A simple test for the presence of *removable* hypo in prints thought to have been thoroughly washed can be carried out with an alkaline solution of potassium permanganate. The following Kodak formula HT-1a can be used:—

Potassium permanganate	10 gr.	1.2 gm.
Sodium hydroxide	21 gr.	2.4 gm.
Distilled water to make	20 oz.	1000 c.c.

Take 8 ounces (250 c.c.) of pure water in a clear glass vessel and add ¼ drachm (1 c.c.) of the above solution. Take six 4 x 4 in. prints, or their equivalent in area, from the wash water and allow them to drain into the test solution. If the purple colour changes to orange in about half a minute, or worse still, is almost completely discharged, the presence of hypo is indicated, and further washing is needed until a negative result is obtained with the test.

It should be noted that organic matter in the water supply can react with potassium permanganate in the same way as hypo. Most public water supplies are free from organic matter but if it is found that whenever prints are tested the colour of the permanganate is changed, then water from the tap should be tested to see if the same result is secured.

The permanganate test only reveals hypo that can be washed from a print. The small residue held by the paper fibres and which cannot be removed however long washing is given is not detected. This is a very small amount which does not matter in prints which are not required to have a very long life. It is sufficient however to cause deterioration of the image in the course of many years, particularly if the print is subjected to high temperatures and damp conditions.

Hypo Eliminator

For maximum permanence the use of a hypo eliminator is necessary which oxidises the hypo in the paper to some harmless substances such as sodium sulphate. Kodak hypo eliminator HE-1 is very satisfactory:—

Cold water	10 oz.	500 c.c.
Hydrogen peroxide (20 vol.)	2½ oz.	125 c.c.
Ammonia (3 per cent. solution)	2 oz.	100 c.c.
Water to make	20 oz.	1000 c.c.

To make 3 per cent ammonia, 9 parts of .880 ammonia should be diluted to make 100 parts of solution. After having washed the prints in the normal manner they should be immersed in the hypo eliminator for about 6 minutes at 70° F. They are then washed for a further 10 minutes before drying. About 10 whole-plate prints or their equivalent can be treated in 1 pint of the solution, but it should be used only once and then thrown away.

Certain unpleasant effects may be encountered when using this hypo eliminator. If, with some papers, an objectionable change of tone takes place add 15 grains of potassium bromide to each quart of the solution (1 gm. per litre). Slight yellowing of the whites can be avoided by immersing the prints in a 1 per cent. solution of sodium sulphite just before the final wash.

It is not suggested that the foregoing treatment should be applied to every print, but it is worthwhile for special work. Another use for the hypo eliminator is for reducing washing times when it may be difficult to give the full hour or two hours in the case of double-weight papers. Twenty minutes thorough wash followed by hypo eliminator is as effective as full time of washing in running water, but is a little more troublesome to carry out.

Print Drying

Only to the busy professional does the drying of prints present any problem. The amateur can remove surplus water with photographic blotting paper or by swabbing with a viscose sponge and spreading the prints out, face upwards, on clean newspapers. Drying takes several hours even in a warm room but that matters little as a rule. Drying can be speeded up considerably by clipping the prints on a line slung across the room, and if there are only a few of them they can be suspended near the fire if they are wanted in a hurry. They must not be placed so near that they can scorch or the gelatine melt.

Print Dryers and Glazers

Many kinds of print drying machines are available to the pro-

essional for the drying or glazing of prints in large quantities, nd there are smaller versions of the simplest types for the mateur. The simplest dryer is the flat-bed variety which onsists of an electrically heated platform with a cloth that can e pulled tightly over it. The prints are laid face upwards etween platform and cloth, where they dry in a matter of minutes. Glossy prints can be squeeged into contact with a hromium plated or stainless steel sheet which is placed on the latform and the cloth pulled over it. When dry—again this akes only minutes—the prints fall from the glazing sheet ith a highly polished surface which gives sparkle to a print y increasing the effective density of the shadows. Prints for eproduction by any of the photomechanical processes should lways be glazed.

Rotary machines are available for continuous drying and—f necessary—glazing. Wet prints are placed on a travelling loth band which brings them into contact with a heated drum. When glazing, a squeegee roller forces the emulsion of each rint into intimate contact with the highly polished surface of he drum. For prints which are not to be glazed the squeegee oller is thrown out of action and the backs of the prints only ome into contact with the drum. Many hundreds of photo-raphs can be dried in an hour with machines of this kind.

The photographer who wishes to glaze a few prints occa-ionally can do so without a machine by squeegeeing them on o a suitable polished surface and allowing them to dry aturally. When drying is really complete—and it takes longer han usual as moisture can only evaporate from the backs of he prints—the photographs can be pulled readily from the lazing sheet or will fall off without help. Not only will they ave a glazed surface but they will lie practically flat instead f having the nasty curl associated with prints dried flat on aper or hanging up.

Glazing Sheets

The principles of glazing are simple. The wet and therefore ery soft emulsion is literally moulded to the surface on to hich it is squeegeed, and as it hardens on drying it retains

the same kind of surface permanently unless the print is wetted again. The best glazing surface is plate glass, but glazing sheets of chromium plated copper, stainless steel, enamelled iron, and even plastic sheets such as 'Perspex' or celluloid give good results and are free from a defect which makes plate glass unreliable: a tendency of the dry prints to adhere so tightly that they can only be removed by soaking in water again.

Plate glass should be scoured before using for the first time, using warm soapy water and a soft nail brush. After thorough rinsing, the surface should be thoroughly dried and then polished with a mixture of french chalk and methylated spirit or one of the proprietary preparations used by the housewife for window cleaning. Remove all traces of the dry chalk with a soft clean cloth.

Glazing Prints

The emulsions of wet prints should be wiped with the palm of the hand under a running tap to remove any possible grit or scum and then placed into contact with the glazing sheet without draining. The prints must then be squeegeed into close contact with the sheet, using a flat or roller squeegee, whichever is preferred. A final and fairly heavy pressure with a sheet of photographic blotting paper laid over the backs of the prints will ensure freedom from air-bells and will also remove surplus moisture.

Drying is best left to take place naturally overnight in a warm room. To speed drying a cool draught from a fan will help, but any form of heat should be used cautiously especially when using glass as it increases the risk of sticking. Prints may fall off the glass when bone dry or they should peel readily when a corner is lifted. If force is required be careful! It is easy to tear the print. Better to soak the glass in water for an hour or so and remove the prints in one piece. Sticking prints are rarely encountered with other forms of glazing sheet but the glaze given by plate glass is so much better than that of its nearest competitor that it is worth mastering.

The use of a glazing solution containing oxgall and formalin

elps to prevent sticking when using plate glass and the ollowing precautions will almost certainly prevent the rouble:—

(1) Use an acid hardening fixing bath,
(2) Avoid excessive heat while drying,
(3) Have the glass scrupulously clean.

The last point can be a pitfall. When once a glass has been horoughly cleaned, on subsequent occasions only wipe it over igorously with a damp cloth and dry off with a clean duster. The use of soap every time, or worse still, nitric acid, caustic oda or similar harsh cleansers causes sticking. Once in good ondition a sheet of glass will give trouble-free glazing until t is broken.

Prints hardly ever stick to chromium plated or stainless teel glazing sheets and these need only be wiped over with varm water, dried, and polished with a soft cloth before use. Care must be taken not to scratch the polished surface by he use of harsh materials or a dirty polishing cloth as defects n the glazing surface means similar defects in the print surfaces. An occasional clean with hot soapy water using a good uality castile soap is good for chromium plated and stainless teel sheets. Ferrotype sheets need very careful polishing as he surface is very soft, and this, of course, applies equally o plastic sheets. Neither of these types must be subjected to emperatures higher than about 140° F. as plastic material vill warp and the enamelled surface of ferrotype sheets will be retrievably ruined.

A well glazed print looks immaculate ; a badly glazed one eflects little credit on the photographer. There is little to go rong in the glazing process, but the few faults that can ccur are dealt with in the table on page 124.

The subject of bromide papers has been discussed fairly ully and most of the remarks made apply equally to chlororomide papers, in fact the fast chlorobromide papers such as romesko and Plastika can be handled in exactly the same ay as bromide papers and the prints will show just a hint of armth which is quite pleasing. It is only when it is desired to roduce really warm tones that it is necessary to deviate from

straightforward bromide printing technique. In the paragraphs that follow the methods of securing warm tones are described.

Chlorobromide Papers

Chlorobromide papers are widely used by the pictorialist and the professional portrait photographer for the sake of the ease with which tones ranging from warm black to warm sepia can be secured at will. Also, it must be admitted that chlorobromide prints have an elusive ' quality ' that is difficult to attain on bromide paper.

As their name suggests, chlorobromide papers are coated with an emulsion composed of a mixture of silver chloride and silver bromide, and they are invariably slower in speed than bromide papers, although the fastest of them require only about one and a half times as much exposure as bromide paper provided that one is content with an image colour with minimum warmth. Some on the other hand are so slow that they are little faster than chloride contact papers and can be used conveniently only for contact printing. The fast papers of this type owe their high speed to dye sensitizing whereby the inherent sensitivity of silver halides is extended into the blue-green so that better use is made of the light used for printing.

Warm Tones

The warm coloured images of chlorobromide prints consist of metallic silver as in the case of other types of printing paper but the grain of the silver deposit is so fine that the particles are of the same order of size as the wavelengths of light, which gives rise to selective absorption. All the practical steps taken to increase the warmth of tone merely decreases the grain size. Using an energetic developer to increase the grain size produces colder tones and it is possible to secure an almost neutral black. These points are mentioned to dispel any idea that the image contains coloured metallic compounds of the same kind found in prints that have been toned.

Bromesko and Plastika

The best-known of the fast chlorobromide papers are Kodak

Bromesko and Ilford Plastika. They can be handled, if desired, in exactly the same way as ordinary bromide papers, using the same developer and time of development. The colour of the image is black with a hint of warmth, but the tone is cold enough to be quite satisfactory for prints intended for reproduction.

Two points have to be watched. One is the safelight used for illuminating the printing room. One suitable for bromide papers may prove unsafe and give rise to fog when used for fast chlorobromide papers. Bromesko can be handled in the light from a Wratten OB safelight filter and Plastika requires an Ilford S filter. In cases of doubt, the simple test of exposing a piece of paper on the working bench for 5 minutes with a penny laying in the centre of it will reveal, after development in the usual way, whether or not the light is safe. The second point concerns contrast grades. In general, chlorobromide papers are more contrasty, grade for grade, than bromide papers in order to compensate for the lengthening of the useful exposure scale that takes place when a restrained, warm-tone developer is used.

Warm-tone Development

To produce warm tones on a chlorobromide paper we merely have to curtail development, which reduces the grain size of the image. It is not practicable to do this merely by reducing the time of development as it is likely to give rise to unevenness in the print. There are other methods which can be used:

(1) The developer can be diluted with water,

(2) Extra potassium bromide can be added,

(3) A special developer of low energy can be used.

Diluting a normal metol hydroquinone developer with an equal volume of water and keeping the development time at the usual 2 minutes will result in slight increase in warmth of tone. Increased exposure will be needed to compensate for the dilution and the contrast of the print will be a little lower than one developed in normal strength developer. For more warmth still further dilution may be practicable but carrying this process too far is likely to lead to greenish tones, flat prints, and loss of quality.

Restrained Development

Perhaps the most convenient method of increasing the warmth of tone is by adding more potassium bromide to the developer. This can be kept in the form of a 10 per cent. solution ready for use when required. The precise effects of such additions depend on the paper and the developer used, but a few simple experiments will yield all the information needed. It is essential to add carefully measured quantities of the potassium bromide solution to a known amount of developer otherwise the experiments will be useless. Once more, exposures have to be increased to make up for the extra restrainer and contrast is reduced. A standard development of 2 minutes at 65° F. is still maintained.

Special Warm-tone Developers

For developers specially intended for production of warm tones it is advisable to consult the paper manufacturer's literature. Kodak recommend two developers for warm tones on Bromesko, D156 for medium warmth and D166 for maximum warmth. In the table on page 79 are set out the three Kodak developers D163, D156, and D166 which represent a comprehensive set for the photographer using Kodak bromide and chlorobromide papers.

Ilford recommend two developers for Plastika, ID20 for normal use and ID49 for warm tones. These are set out in the table on page 79.

Using Chlorobromide Papers

In chlorobromide printing we have the added complication of image colour to take into consideration. Exposure times have to be adjusted to give the right depth of print with 2 minutes development at 65° F. for the developer used and for the colour desired. It is hoped that the reader will forgive the insistence on a fixed time of development and a standard temperature, but it is only by fixing these two variables that consistent and predictable results can be obtained especially when using warm-tone papers. An easier method is to expose for the depth of print required and to accept the image colour

ILFORD PAPER DEVELOPERS

ID.20	Metric	Avoirdupois
Metol	1.5 gm.	15 gr.
Sodium sulphite (cryst) ...	50 gm.	1 oz.
or Sodium sulphite (anhyd) ...	(25 gm.)	(½ oz.)
Hydroquinone	6 gm.	60 gr.
Sodium carbonate (cryst) ..	80 gm.	1½ oz.
or Sodium carbonate (anhyd)	(30 gm.)	(1oz. 26gr.)
Potassium bromide ...	2 gm.	20 gr.
Water to make	1000 cc.	20 oz.
	Dilute 1 to 1	

ID.49	Metric	Avoirdupois
Metol	0.175 gm.	1.5 gr.
Hydroquinone	1.5 gm.	13.5 gr.
Chloroquinol	1.5 gm.	13.5 gr.
or Sodium sulphite (anhyd) ...	50 gm.	1 oz.
Sodium sulphite (cryst) ...	(25 gm.)	(1 oz.)
or Sodium carbonate (anhyd)	16.5 gm.	½oz. 110gr.
Sodium carbonate (cryst) ..	(6.6 gm.)	(212.5 gr.)
Potassium bromide ...	0.45 gm.	3.75 gr.
Water to make	1000 cc.	20 oz.
	Use undiluted	

KODAK PAPER DEVELOPERS

	D.163		D.156		D.166	
	Metric	Avoirdupois	Metric	Avoirdupois	Metric	Avoirdupois
Metol	2.2 gm.	20 gr.	1.7 gm.	15 gr.	1.15 gm.	10 gr.
Sodium sulphite (cryst) ..	150 gm.	3 oz.	44 gm.	¾ oz. 55 gr.	50 gm.	1 oz.
or Sodium sulphite (anhyd)	(75 gm.)	(1½ oz.)	(22 gm.)	(½oz. 82gr.)	(25 gm.)	½ oz.
Hydroquinone	17 gm.	¼ oz. 40 gr.	6.8 gm.	60 gr.	8.5 gm.	75 gr.
Sodium carbonate (cryst)	175 gm.	3½ oz.	44 gm.	¾ oz. 55 gr.	68 gm.	1 oz. 165 gr.
or Sodium carbonate (anhyd)	(65 gm.)	(1oz. 130gr.)	(16 gm.)	(½oz. 28gr.)	(25 gm.)	½ oz.
Potassium bromide ...	2.8 gm.	25 gr.	6.3 gm.	55 gr.	12.5 gm.	¼ oz.
Water to make	1000 cc.	20 oz.	1000 cc.	20 oz.	1000 cc.	20 oz.
	Dilute 1 to 3		Dilute 1 to 1		Dilute 1 to 3	

that results. This method is a useful one if one's views on image colour are catholic as it gives considerable latitude in exposure. For example, if at the expiration of 2 minutes in the developer a print is obviously too light there is nothing against prolonging the development until it is dark enough. The image colour will be colder than if development could have been terminated at 2 minutes and the contrast will be some-

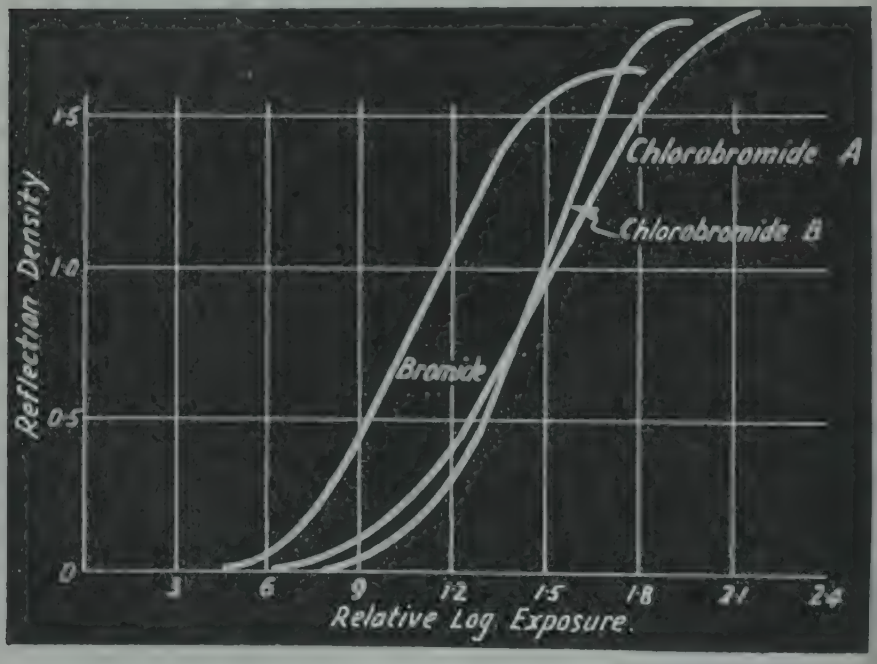


Fig. 20

Characteristic curves of three glossy printing papers, one a bromide and the other two fast chlorobromides. The denser maximum black of the chlorobromide papers can be seen clearly.

what greater but that is all. Conversely, it is safe to reduce the time of development for a print that threatens to become too dark if developed to 2 minutes. If the time given is very much shorter than this the quality of the print is likely to suffer, but it will be found that there is more latitude in this respect than with ordinary bromide papers.

The experienced photographer finds no difficulty in judging the depth of a black tone print while it is in the developer, but warm-tone prints are misleading. The warm colour of the safelight makes the warm print image look lighter than it actually is, and in addition, very warm tones dry very much darker. These points must be borne in mind, but with practice, due allowance can be made without difficulty.

The warning given previously concerning prolonged fixation of prints must be repeated because it is so important with warm-tone prints. They must not be fixed for longer than the 10 to 15 minutes necessary for the complete removal of the unexposed silver halides. A warm-tone image, because of its fineness of grain, is attacked by a fresh acid fixing bath if it is allowed to act for too long. Oxidation of the print image is accelerated if prints are allowed to float face upwards in the bath so that air comes into contact with the emulsions. Particular care is needed when using rapid fixing solutions such as 'Amfix'.

Multigrade Paper

A most useful paper is Ilford Multigrade. The contrast of this paper is variable from very soft to hard by merely changing the colour of the light by which it is exposed. This obviates the need for keeping in stock a variety of paper grades, as Multigrade can be used for any printable negative. The paper is coated with two emulsions instead of the usual one. One emulsion is a very soft one and it is non-colour sensitive ; that is, it is sensitive only to violet and blue light. The second emulsion is of high contrast and is colour sensitized to the blue-green region of the spectrum. It is thus only necessary to regulate the colour of the printing light to control the relative amounts by which the two emulsions are affected.

The colour of the printing light is altered by placing suitable filters over the enlarger lens. Exposures made with no filter give the equivalent of a very soft grade of paper and the following Multigrade filters are available which have the effect of increasing the contrast.

The speed of Multigrade is decreased as the printing light is made more and more yellow owing to the fact that the contrasty emulsion is very much slower than the soft one and the

MULTIGRADE FILTERS

MULTIGRADE FILTER	CONTRAST OF THE RESULT
No Filter	Extra Soft
Light Yellow	Soft to Normal
Medium Yellow	Normal to Hard
Deep Yellow	Hard

yellower the light, the less the soft emulsion is affected. A paper of this kind is even more useful than a series of ordinary papers of various grades as the contrast is continuously variable. It often happens with ordinary papers that a negative yields a print that is too soft on a normal paper and yet one that is too contrasty on a hard paper. With Multigrade the exposure scale can be made to suit almost any negative, by giving only part of the exposure through a filter.

A paper similar to Multigrade is available in U.S.A. This is Defender ' Varigam ', the contrast of which is also varied by altering the colour of the printing light. This time however, the grade of the paper becomes softer as the light is made more yellow—just the reverse of Multigrade.

Chapter 3

PRACTICAL ENLARGING

In previous chapters we have dealt with the tools for the job—the enlarger and the printing paper, in the belief that no tools can be properly used unless they are fully understood. We can now go ahead with the practical matters arising in the making of enlargements.

The Printing Room

It is assumed that the photographer has a room fitted up for enlarging, whether this be a fully equipped printing room with running water or just a corner of the kitchen or bathroom pressed into service when not required by the other members of the household. The quality of an enlargement is far from being in direct relationship to the opulence of the place in which it was made but one item contributes a great deal towards good results. That is adequate illumination with light that is perfectly safe for the printing papers used.

Safelights and Filters

A comparatively inexpensive luxury is one or two 10 x 8 inch safelight lamps with suitable safelight filters. A wide variety of lamps is available and the choice is largely a matter of personal preference. The important point regarding safelights is to choose the correct filter for the material used and to employ it in conjunction with the power of electric lamp recommended by the makers. A more powerful lamp than the one specified will give more light but it may cause fogging, and the extra heat radiated by it may cause the dyes used in the filter to fade badly.

One safelight should be placed so that it illuminates the

developing dish, and the second one—if two are used—should light the enlarger and its surroundings. It is convenient to have this safelight controlled by a handily placed switch so that it can be turned off while the enlarger is being focussed. Even a moderate level of illumination on the enlarger easel makes focussing difficult and it is often helpful to have the light out when shading, particularly if the negative being enlarged is dense.

If the walls and ceiling of the printing room are light in tone there should be a fair amount of reflected light from the safelights to illuminate dark corners and enable things to be found without groping. In a large room or in one with dark walls, a portable safelight is useful for finding elusive accessories. A cycle lamp can be modified by fitting an orange glass in place of the colourless one, but the light should be tested for safety before using it. Regarding the walls of the room, any area very near the enlarger should be painted matt black or covered with black paper as a precaution against any white light from the enlarger being reflected on to the printing paper and fogging it.

Time and Temperature

Two further pieces of equipment are essential for good enlargements—a clock and a thermometer. A proper darkroom timer with a sweep seconds hand is easily read in the light of the printing room but any timepiece with this refinement is suitable. An alternative is a metronome which gives audible notice of the passing of the seconds. One soon becomes accustomed to counting the ticks and there is no need to keep one eye on a dial. As long as the intervals between ticks are consistent it does not matter if they are not exactly seconds.

The thermometer is for checking the temperature of the developer at frequent intervals. The road to print quality lies through a dish of developer at between 65° and 70° F. and to ensure that this level is maintained it is not sufficient to feel the solution with the fingers. Choose a thermometer with a column of blue fluid which can be easily seen in orange light and make sure that the scale is boldly marked in black. A

lip of plastic material to hold the thermometer in the corner of the developing dish enables a wary eye to be kept on the emperature and protects the glass against breakage.

Heating Devices

f the printing room is cold some means must be found for keeping the dish of developer at the required temperature. A half-biscuit tin with a carbon filament lamp burning inside t as described on page 55 is effective in even a really cold room. A rubber hot water bottle filled with nearly boiling water can be used with the developing dish supported over it on blocks of wood. If the temperature of the developer rises to over 70° F. the bottle will have to be removed temporarily.

Cleanliness

These highly important preliminaries dealt with we can turn our attention to the enlarger. Before starting work make sure that the condenser, lens, and negative carrier glasses—if any —are scrupulously clean. Dirty condenser lenses mean loss of valuable light ; a dirty lens means flat and foggy prints, and dirt or dust in the same plane as the negative will cause crops of white spots on enlargements. A plastic cover for the enarger when it is not being used saves a lot of trouble and ime spent in cleaning.

Before placing the negative in the carrier, dust it back and ront with a soft brush to remove particles of dust, and in the ase of a glass negative see that the back is free from scum left by plate backing or hard water. Do not dust or clean negatives or carrier glasses too vigorously just before using them as riction generates charges of static electricity, especially in a lry atmosphere, and such charges attract dust like a magnet ttracts iron filings. Gently breathing on glass while dusting t has been suggested as a remedy for static, but the authors nave never found it very successful.

The negative goes in the enlarger with the emulsion towards he lens. If it is inadvertently inserted with the emulsion facng the light source, the enlargement will be laterally reversed nd scenes therein will appear as if seen in a mirror. Some-

times this device can be used intentionally with a picture that may look better the wrong way round, but it is annoying to do it accidentally.

Flatness of the Negative

A plate negative naturally remains perfectly flat in the enlarger and negative carriers for any but 35 mm. negatives are usually provided with two sheets of thin plate glass between which films are sandwiched to keep them flat. Glassless negative carriers are desirable from the point of view of dispensing with potentially dusty surfaces but they give trouble through allowing the negative to buckle. Even for 35 mm. negatives the glassless carrier is not an unqualified success unless the design of the enlarger is such that the lower face of the condenser presses the film flat.

A common experience with a miniature enlarger is something like this: a negative is focussed carefully and a test print made which is found to be perfectly sharp. Then the full-size print is made and upon close inspection in white light it is found to be not quite as sharp as the test strip. The trouble is that the film gradually warms up in the radiated heat from the enlarger lamp, its emulsion becomes perfectly dry and the film pulls quite taut and moves very slightly nearer to or further from the lens. Alternatively it becomes really hot and buckles, which again causes poor definition.

There is no simple remedy ; if focussing is done quickly and a test exposure made without delay and the enlarger lamp not left burning longer than is necessary there is a good chance that negatives will not undergo a significant rise in temperature. If exposures are long however, this chance is a slim one. Fitting a heat-absorbing glass between the lamp and condenser will help to keep the negative cool but such glass allows about 10 per cent. of the heat rays to pass.

If trouble arises with a glassless negative carrier and the foregoing devices fail to cure it, then the only remedy is to fit the carrier with two thin glasses and to keep dust off their surfaces as far as is humanly possible. The real secret of keeping film flat without glasses is to clamp it securely along

TONE SCALE

making a print it
s not necessarily
ow that the whole
he tone scale of the
er should be used.
the first picture,
ch is a misty scene,
y the lighter tones
e been used, there
ng no really black
dows. In the second
ut the whole of the
e of the paper from
k to white has been
ployed, while in the
d print it is chiefly
dark tones that
e been used.

TEST STRIPS

One of the most important operations in making an enlargement is the determination of the correct exposure time by means of a test strip. An opaque card moved in steps across the printing paper enables a graduated series of exposures to be given.

A. A trial print which has received a series of exposure times in geometric progression—5, 10, 20, 40 and 80 seconds. Notice that the density increases are quite even.

B. A trial print from the same negative but given a series of exposures in arithmetic progression—5, 10, 15, 20 and 25 seconds. It can be seen how the density increases become less as the exposure becomes longer, and that is why an arithmetic series should not be used.

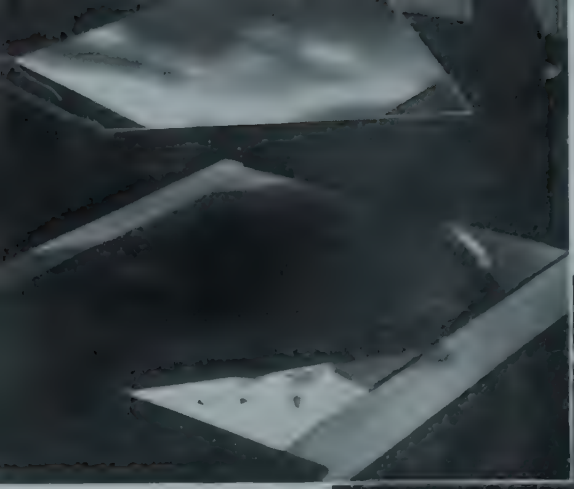
Water-bath development as described on page 109 is a useful method for reducing the contrast of a print without recourse to a softer grade of paper. The first print received 8 seconds exposure and straight development; the second, 16 seconds exposure and water-bath treatment. The improvement is plainly visible even in a half-tone reproduction.

HIGHLIGHT GRADATION

This series of three pr
shows the progressive
provement in highl
gradation as the depth
the print increases.
first print is too light
good highlights; the
cond is about right,
the third, although
highlight gradation is
cellent, is so dark tha
has a muddy appeara
and the shadows are
clined to be clogged.

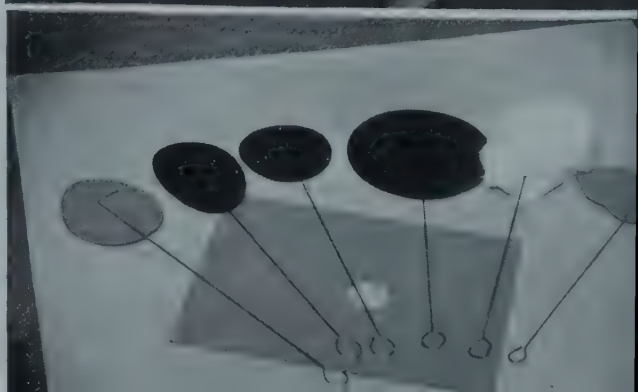
The placing of the test strip on the image is an important matter. In the upper picture it is wrongly placed running from foreground to sky so that each section contains a different group of tones. In the lower picture the strip is placed correctly so that each section contains a representative collection of tones.

SHADING

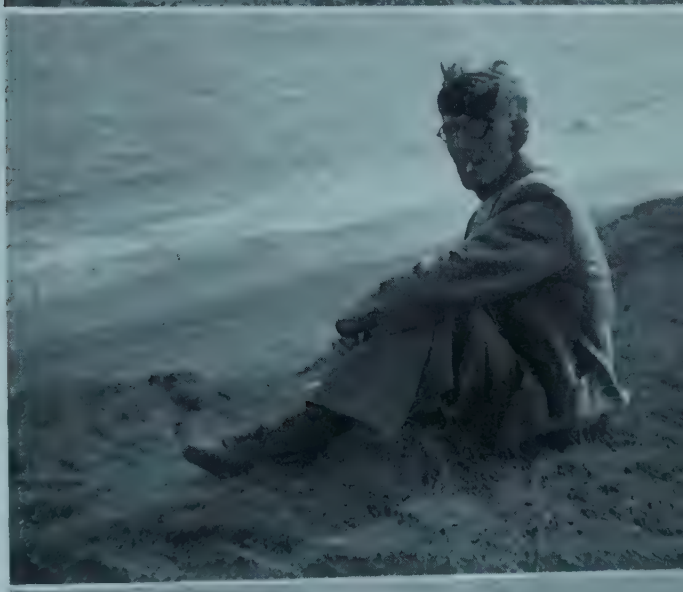


Above: An actual photograph of shading during the exposure of an enlargement. A piece of card is being held between the lens and the printing paper in order to darken the corners of a portrait. The card is kept on the move in order to avoid a hard edge between the shaded and unshaded portions of the picture.

Another photograph taken in the printing room while an enlargement is being shaded. In this case the photographer's hands are being used. The hands can be used very successfully for shading and printing up and it is surprising the variety of shapes that can be made with them.



A collection of homemade devices for shading and printing up. It includes discs and ovals on wires and cotton wool and "Plasticine" which can be pressed to almost any shape.



make a good en-
ement of this sub-
careful shading was
ntial. At the top is
wn a print for which
figure was correctly
osed: in the middle
hown correct expo-
e for the back-
und, and below is
result of printing
the background
a suitably shaped
d. Although this
done carefully, it
possible to see a
htly lighter area
und the head, a
lt which should
e been avoided.

These two prints show the usefulness of general shading with the hand or a piece of card for correcting uneven illumination of the subject. In the straight print (*above*), which was given 20 seconds exposure, the right hand side of the picture is too dark; the left hand side is satisfactory. In the shaded print a sheet of card was used to hold back the right hand side beginning after 10 seconds had elapsed, the card being moved slowly across the paper so as not to cause a hard line.

BRIGHTNESS
SCALE
OMPRESSION

here are some-
nes exceptions to
e rule that a con-
asty negative
ould be printed
a soft grade of
inting paper. In
e first picture is a
raight print on
ft paper and al-
ough the result is
asonably satisfact-
y the gradation in
oth the sky and the
urch is flat. In
e second print, a
raight one on nor-
al paper, the sky
bright and spark-
ng but the church
too dark and the
adows are clogged
. In the third
int, also on nor-
al paper, the
urch has been
refully shaded
uring enlarging
nd the result is far
etter than the
raight print on
ft paper.

Above: This test shows the effects of scattered light from the enlarger lens. Half of the negative carrier was blocked out with black paper and an exposure made with a dirty enlarger lens. Coins were laid on the paper within the area which should have printed white. Scattered light caused fogging which shows the outline of the coins quite clearly. Cleaning the lens reduced the effect to a negligible amount. *Below*: Vibration of the enlarger causes a blurred image. An exceptionally bad case caused by a door slamming.

Above: Two home-made diffusion discs. The one on the left consists of concentric rings drawn with office gum on a lantern slide cover glass; the one on the right is a piece of crumpled "Cellophane" sandwiched between lantern slide cover glasses.
Below: Diffusion discs for use on the enlarger lens can be made by drawing concentric circles with office gum on a piece of plain glass as shown in the photograph. The more circles are drawn the greater the degree of diffusion.

DELIBERATE DISTORTION

Here, slight distortion has been deliberately introduced in making the enlargement in order to make the model's face look less full. The first is a perfectly straight print, but in the making of the second one the printing paper was tilted a little in order to make the face narrower.

all four edges but very rarely indeed does one find a carrier that does this.

Cleaning Dirty Negatives

Occasionally one may have to enlarge a negative which has become dirty and badly scratched so that the abrasions show in the enlargement. To save hours of spotting when the print is dry the film should be cleaned with carbon tetrachloride, polishing off the solvent with a soft cloth. Then the negative should be sandwiched between glasses in a layer of glycerine. Take care to exclude all air bubbles and wipe off surplus fluid which oozes from the edges of the glasses. A marked improvement can be effected in this way unless the scratches are so severe that they have damaged the image itself. The glycerine can be washed off the negative with cold water after enlargements have been made.

Focussing the Image

To facilitate focussing, a sheet of clean white paper should be fixed to the enlarger easel in the same plane that will be occupied subsequently by the printing paper. A dirty sheet of paper not only makes focussing difficult but may hide a defect in the projected image such as a dark mark caused by an undetected piece of dust or a dark line caused by a hair on the negative.

It is at this stage that the picture can be made or marred. We have our subject material in our negative—in all likelihood far too much of it—and by enlarging only a selected portion of it and arranging it carefully in the picture space it is often possible to convert it from a mediocre picture to one that is very much better. To make composing the picture easy, the sheet of paper on the easel should be exactly the same size as the enlargement, or just a very little smaller to allow for a narrow white border or subsequent trimming of the paper edges which are usually a little rough after developing, fixing, and washing.

Instead of starting with the projected image small on the easel and gradually making it bigger and bigger until the paper is adequately filled, a better plan is to start with the

image far too large and to make it gradually smaller. This method makes it easy to avoid the all too common fault of having the subject too small in the enlargement and surrounded by irrelevant detail which has to be trimmed off afterwards. This is a waste of paper to say the least of it. Forceful pictures are invariably those in which the subject is boldly shown and all extraneous detail rigorously excluded.

What Degree of Enlargement?

At this point we may well ask how big can a negative be enlarged without the quality of the print suffering. The answer to this question depends on two things—definition and graininess. A really sharp negative will go up to almost any size but negatives are not always critically sharp. It can be said however, that if a whole-plate enlargement from a negative looks acceptably sharp then it can be enlarged with safety to any size. A whole-plate print is about the largest size that can be looked at from the minimum viewing distance of from 10 to 12 inches. Prints bigger than this will be looked at from greater distances—the bigger the print the greater the distance—so that the progressive loss of definition through more and more enlargement passes unnoticed unless one cheats and scrutinizes the picture closely. The test strip made preparatory to exposing a big enlargement will reveal instantly if the enlarging process has been overdone. It must be borne in mind that a negative which looks critically sharp to the unaided eye may fall down badly when enlarged only a little. Camera-shake is the fault responsible in many cases.

Negative Graininess

Excessive graininess can severely limit the size of enlargement that can be made from an otherwise good negative, but this is normally only troublesome to the user of a 35 mm. camera. There is something drastically wrong with the processing technique if a negative $2\frac{1}{4}$ inches square or bigger cannot be enlarged to 20 x 16 inches without an unpleasantly grainy image resulting.

A perfectly sharp enlargement from a grainy negative will show the graininess clearly defined all over the print. A good

test of the definition given by an enlarger is, in fact, to enlarge a very grainy negative. Throwing the focus very slightly out makes the graininess unobtrusive without generally making the print look objectionably unsharp. Alternatively, a diffusion disc or a piece of bolting silk placed in front of the enlarger lens during exposure will subdue grain. A paper with a rough surface will hide it better than a glossy or velvet paper. These simple points are worth remembering when one has to enlarge a negative which is excessively grainy.

Focussing Aids

No matter how sharp a negative is, great care is needed to ensure that the good definition is perpetuated in the enlargement. Using an efficient enlarger and having a thin negative of good contrast, and with some fine detail in it, there is no difficulty in adjusting the focus to secure optimum sharpness in the projected image. Focussing should be done with the enlarger lens at full aperture so that the image on the easel is as bright as possible and so that the position of the lens for best definition is most easily found. It is better to focus at about the centre of the image as sharpness is generally more important here than anywhere else. With some lenses not primarily intended for enlarging purposes it may be better to stop down to one stop larger than the one it is proposed to use when exposing before focussing as in some cases stopping down alters the focal length slightly.

A dense negative of low contrast is rather difficult to focus. It is helpful if there is a tiny pinhole in the negative which can be seen plainly on the easel. A further aid is to switch off all lights in the room so that it is perfectly dark. If it is still difficult to focus, a focussing negative can be substituted for the negative in the enlarger. It can be either an old dense negative ruled across with intersecting lines with the point of a needle, or special focussing negatives are obtainable for a few shillings. These have on them a line image of some geometric pattern (Fig. 21). When the image on the easel is absolutely sharp the negative to be enlarged is returned to the carrier.

The use of a focussing negative presupposes that the carrier

of the enlarger always holds the negative in exactly the sam relative plane. Any doubt on this score means possibl 'wooliness' in the enlargement and it is better to focus wit the negative being printed however difficult the operation ma be.

Sometimes an automatic focussing enlarger has a sma manual lens movement which can be used for critical focus

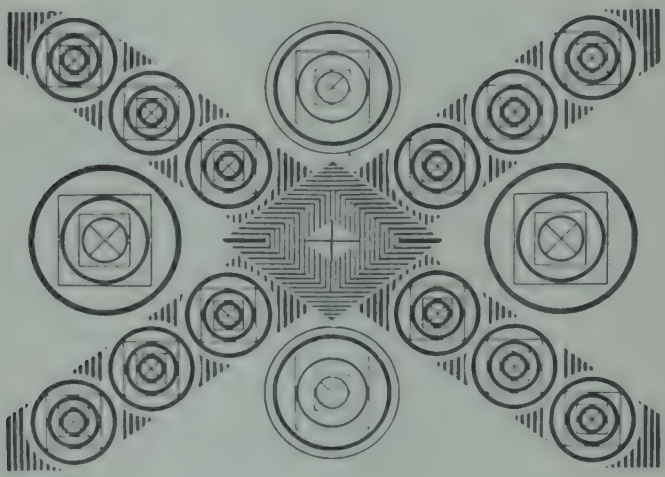


Fig. 21

This is a print from a focussing negative—a useful device if for an reason focussing presents any difficulties. It is substituted for th negative being enlarged, focussing is carried out, and then the origin negative replaced The black and white pattern makes it easy to se when the image on the easel is sharp.

ing or when it is necessary to place the printing paper in plane other than the usual one it occupies. For example, paper holder and masking board may be used for small print and discarded when making big enlargements involving quit a big change in the plane of the paper.

Masking the Negative

When enlarging a negative smaller than the biggest that ca be accommodated by the negative carrier it is essential t have an opaque mask of black paper or thin metal to eliminat

the powerful light that streams past the edges of the negative to the lens. If this precaution is not taken it is certain that enlargements will be degraded by light scattered by the lens, and highlight gradation will be flattened. Several enlargers are provided with built-in masks in roughly the plane of the negative and these can be adjusted so as to exclude all light from the lens except that coming from the area of the negative being enlarged.

The theoretical aspects of stopping down the enlarger lens were discussed in Chapter 1. From a practical point of view the amount of stopping down is often determined solely by considerations of the length of the exposure. Given a thin negative, a small degree of enlargement, and a fast printing paper it may be necessary to stop well down in order to secure a manageable exposure time—say one longer than 5 seconds. Under adverse conditions on the other hand it may be impracticable to stop down at all because of the long exposure time involved. Under average conditions it can be said that stopping down one or two stops is desirable for the sake of improved marginal definition and to cover slight focussing and other errors.

Choosing the Grade of Paper

One of the knotty problems in enlarging is the selection of the most appropriate grade of paper for the negative being printed. After some considerable experience the photographer can choose his paper unerringly after a brief inspection of the negative, but the beginner is likely to choose one too hard or too soft more often than not. The problem can be solved by measurement of the highlight and shadow densities of the negative, but a densitometer is an instrument rarely available to the amateur and not often to the professional who can select his paper without trouble in any case. What is more, in pictorial photography the most suitable paper may not be the one with an exposure scale that matches the opacity range of the negative.

Using a Densitometer

Where a densitometer is available then the procedure is simple

and will give first-class results with the big majority of subjects. The negative is explored to find first of all the deepest shadow in which detail is required in the print. The density of this is measured and carefully noted. The density of the highest light (ignoring specular reflections from water and so forth which will print white) is also measured and noted. The difference between these two readings is the density range of the negative and to take a practical example, let us suppose that we have a negative with highlight and shadow densities as follows:—

Highlight density ...	1.7
Shadow density ...	0.3
Density range	1.4

To match the negative to the printing paper the logarithm of the exposure scale must be equal, or nearly so, to the density range of the negative, i.e. 1.4. We require therefore a paper with an exposure scale of 25 to 1 (25 being the antilogarithm of 1.4) which is a soft grade.

It is assumed that the whole of the tone scale of the negative is to be reproduced in the print. This is generally true in technical and commercial photography but in pictorial work it is often considered desirable to let the extreme shadows print as black masses devoid of gradation. In such cases the range of the negative will exceed the exposure scale of the paper. On the other hand subjects of low contrast such as misty landscapes and the like call for neither a full black nor a pure white in the print. In such cases the range of the negative will be less than the exposure scale of the printing paper.

Notwithstanding these occasional exceptions it is a fact that one of the problems in enlarging is to use the most suitable grade of printing paper. The beginner has to decide whether his negative is soft, normal, or contrasty, and in the light of his decision use a hard, normal, or soft paper. Any error of judgment in this matter will reveal itself in the test print which we are now about to discuss.

Exposures in Enlarging

Correct exposure is vital in enlarging and the most widely used method for determining the correct time is by means of a test strip. Paper expended on test exposures is never wasted; the most inspired guesswork rarely results in the best possible print.

A strip of the selected printing paper is laid across a representative portion of the projected image, the orange filter cap being placed in front of the lens while doing so to prevent fogging the paper. A sheet of opaque card is held in readiness so that the test strip can be progressively covered as each section has received the required exposure.

The series of exposure times given to the test strip is highly important. If the photographer has not the slightest idea as to the correct exposure the following series of times is as good as any:—

5, 10, 20, 40 and 80 seconds.

Expose the whole strip for 5 seconds, then cover one-fifth of it with the sheet of card and, when a total of 10 seconds has elapsed, cover two-fifths of the paper. After a further 10 seconds slide the card to cover three-fifths of the strip; after 20 seconds more cover four-fifths. Then, after a further 40 seconds cover the whole of the paper and switch off the enlarger lamp.

It will be seen that the foregoing series of times is a geometric one with a common factor of 2. A geometric series is necessary as it is the only one that gives equal differences of density between the sections of the test strip, and a factor of 2 gives density differences neither too small nor too large. To give a series of times in arithmetic progression results in differences of density which become progressively smaller as the exposures increase.

Development of the Test Strip

Impressed on our test strip we have a number of different exposures, one of which we hope will be the most suitable for the final print. It is important that the conditions of development shall be exactly the same for the test strip as for the final

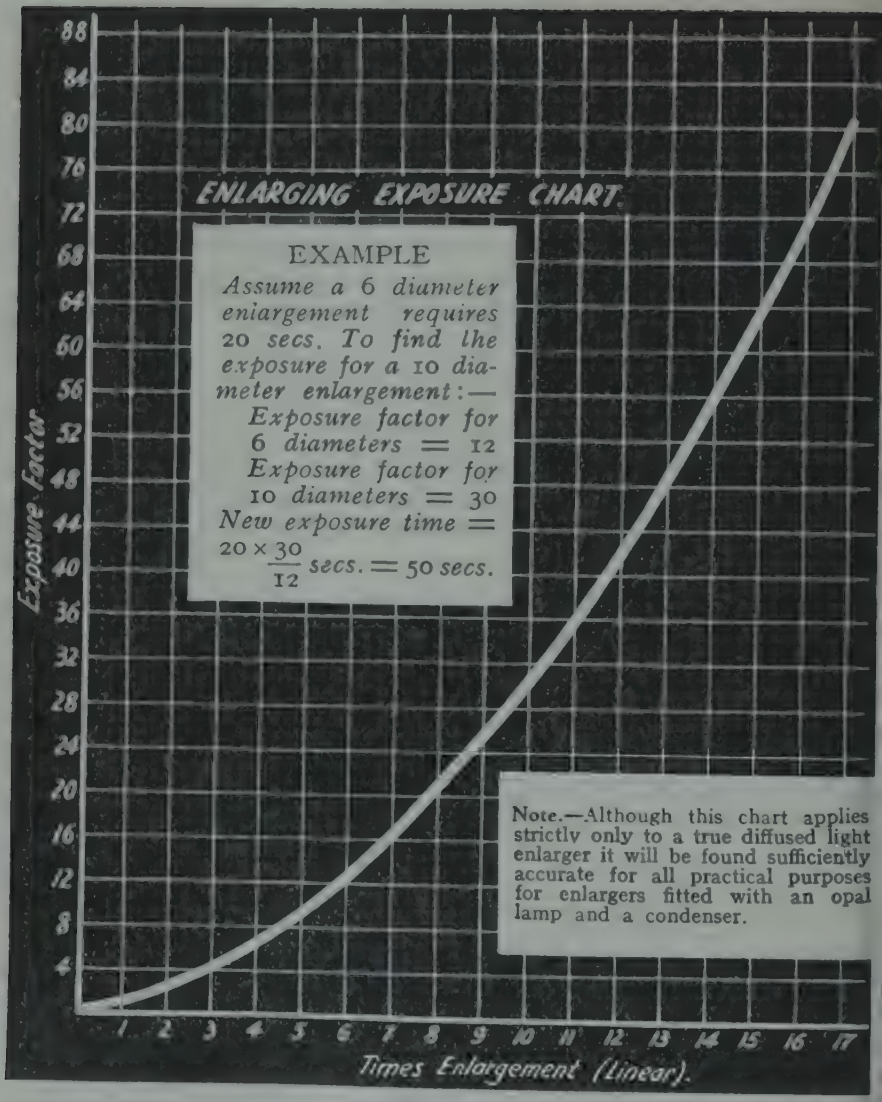


Fig. 22

ENLARGING EXPOSURE CHART

The bigger an enlargement the longer the exposure time it requires. When making a series of prints of different sizes from the same negative, using a diffused light enlarger, there is no need to make a test exposure for each size. Having determined the exposure time for one size, this graph can be used to determine all other exposures.

First of all, find the exposure factor for the enlargement for which the exposure is known. Then find the factor for the new size of enlargement. The new exposure can now be found by simple proportion.

print. The developer should be accurately diluted with the required quantity of water where this is called for, and brought to a temperature of 65° F. The strip should be developed in this for 2 minutes precisely.

Should the test strip develop rapidly and every section threaten to become too dark by the time the 2 minutes have elapsed, the temptation to snatch it from the developer before this time must be resisted. We are trying to find the exposure required to give a print of the desired depth of tone with 2 minutes development, and to curtail development makes the test strip useless. Similarly, a test strip which is all too light at the end of 2 minutes in the developer should not be 'forced up' by increasing the time. It is hardly likely in fact that within a range of exposures from 5 to 80 seconds one will not be found that is appropriate.

If the whole test strip is too light or too dark then a further test must be made giving a series of longer or shorter exposure times. With very little experience, inspection of the image on the enlarger easel will give some idea as to the time needed and a series of only three exposures may be found adequate. It must be confessed that the professional photographer who uses an enlarger all day develops the ability to assess exposures with surprising accuracy, but the amateur rarely has the constant practice necessary to be able to do this.

Inspecting the Test Strip

To decide the correct exposure from a test strip it should be inspected, after a few minutes fixing and a brief rinse in water, in a good white light. The depth of a print is very deceptive under the safelight in the printing room, and until one is able to make allowances for its different appearance, careful inspection in white light is a safeguard against wasted paper. It may well be that the most suitable exposure lies between two of those given to the test, in which case an intermediate time should be given to the final print.

Checking the Paper Grade

At this stage, not only can the most suitable exposure time be selected but it can be seen whether or not the contrast grade

of paper chosen is the best one for the negative and for the result wanted. Correct choice is shown by the correctly exposed section having a full range of tones from full black to nearly pure white with good gradation throughout the scale. A short tone scale with no full black and with highlights reproduced as grey tones indicates a grade of paper which is too soft. On the other hand, a 'soot-and-whitewash' result, with black, clogged-up shadows and white highlights without gradation indicates that the grade of paper is too hard. These standards cannot, of course, be applied to special subjects such as high- or low-key pictures which must be judged solely from the point of view of the kind of result wanted.

Changing the paper for another of softer or harder grade means a fresh test strip because of the differences in speed between one grade and another. It may happen that the first test strip is only a little too soft or too contrasty and a change of paper grade would be too drastic. It may be sufficient to modify the enlarging or processing technique to give a little more or a little less contrast. The following steps can be taken in such a case as this.

To Increase Contrast

(1) Dilute the developer stock solution with less water, say 1:1 instead of 1:3 when using D163.

(2) For cholorobromide paper use a colder tone developer or prolong the development time.

(3) Use a more contrasty developer such as a single solution caustic hydroquinone like Kodak D8.

(4) If possible fit the enlarger with a projector type lamp and a ground glass diffuser in place of the usual opal or white-sprayed lamp.

To Decrease Contrast

(1) For chlorobromide paper use a warmer tone developer or decrease the development time if this can be done without loss of quality.

(2) Use a soft working developer such as plain metol.

(3) Use a diffuser type enlarger if available or in the case of a condenser and point source enlarger, use an opal lamp

or fit a sheet of flashed opal glass behind the condenser.

Any of the foregoing steps will require that a further test strip be exposed, not only to ascertain the correct exposure but also to make sure that the contrast modification is adequate.

Water Bath Development

A very useful method of reducing contrast when one has not a soft enough grade of paper for a particular negative is by what is known as water bathing. The paper is given about twice as long an exposure as is needed for a straight print and as soon as the image appears in the developer the print is immediately plunged into a dish of clean cold water and left for about 30 seconds, the dish being rocked gently to keep the paper covered. In the water, development carries on for a time by virtue of the developer retained by the emulsion but it ceases quickly in the shadows because it is quickly exhausted. In the highlights however, there is very little work for the developer to do and so its action continues for longer.

After 30 seconds the print is returned to the developer but as soon as it is seen that the image is developing again, back into the water it goes for another 30 seconds. This routine is continued until the image is dark enough and then the print is rinsed and fixed in the usual way. The whole aim of the process is to develop the highlights fully but to curtail the action in the shadows so that they do not become clogged. It can be highly successful but it is important to develop the shadows sufficiently for them to have a good colour. Nothing looks worse than the greenish tones that result from insufficient development, but very little practice is required to make water bath development a valuable addition to enlarging technique. One of the secrets of good results is to immerse the paper in the water as soon as there is a sign of an image.

Depth of Print

A difficulty that troubles the inexperienced photographer is in deciding how deep a colour a print should have, with the result that one sees many weak and washy prints, and more rarely, dark and sombre ones. To strike the happy medium is

not easy, and the difficulty is increased by the fact that some papers dry darker than they are when wet. Furthermore, the precise depth required is determined to a great extent by the subject and to a certain extent by the purpose for which the picture is intended. A powerful and dramatic subject generally calls for a rich print, while a delicate subject is better if printed rather lightly. Such matters can only be settled by the taste of the photographer, but in cases of doubt it is always worthwhile to make a further test print giving a single exposure and embracing the important parts of the picture so that the effect of a lighter or darker print can be seen.

Exhibition Prints

Prints intended for exhibition and other display purposes require to be a little heavier than those to be viewed in the hand, and fairly heavy prints are desirable for reproduction processes. A slightly dark print will have better highlight gradation than one a little lighter because the lighter tones are not placed on the extreme toe of the paper curve where the gradient is low. To carry this to extremes, of course, means gloomy-looking pictures which are unpleasant.

Placing the Test Strip

One further point must be mentioned in connection with exposure determination in enlarging by means of a test strip. The placing of the latter on the enlarger easel calls for thought; each section of the strip must contain a representative portion of the subject. It is of no use, for example, having one end of the strip in the sky of a landscape and the other end in a heavy foreground area. The strip must be placed so that each section embraces a piece of sky and some foreground. In cases of difficulty it may be preferable to cut the test strip into several pieces and to expose each one in the same part of the picture. When enlarging a portrait for instance, the pieces should be exposed on the face, which is the most important area in a portrait.

Exposure Latitude

The question may be asked as to whether there is any exposure latitude when enlarging and if so, how much. There is some

latitude but not so much as in negative making where a slightly thin or a rather dense negative can both be made to yield good prints merely by modifying the printing exposure.

Suppose we have made a trial print and on the basis of this, exposed a full size sheet of paper. If all has gone well a good enlargement will result if it is developed for the same time as the test strip, but suppose some error has crept in due perhaps to variations in the mains voltage. At the end of the normal developing time of 2 minutes the print may look too light so we continue development to just short of the point where fog and stains are likely to appear. With most papers it is safe to develop for up to 5 minutes and the extra time in the developer may be sufficient to compensate for the slight under exposure.

Similarly, a print that is dark enough after about $1\frac{1}{4}$ minutes development because of its having received, by accident, rather more than the exposure decided on, can be removed at this point and fixed without detriment. Exposure and development are quite closely related and to a limited extent, errors in exposure *can* be corrected by modifying development. With most bromide papers a 2 to 1 variation in exposure can be handled by varying the development time. What must be avoided at all costs is a development time so short that it fails to produce a full black tone, or a time so long that fog and stains result. Chlorobromide papers have greater exposure latitude if one is prepared to accept the image colour and contrast resulting from the time of development necessary to give a suitable depth of print for the exposure given.

Photometers for Enlarging

The problem of correct exposure in enlarging is of sufficient magnitude to have resulted in the development of devices for computing exposures without the expenditure of valuable printing paper in making test strips. These photometric devices take many different forms but they nearly all work on the same principle ; they measure the light falling on the enlarger easel in the deepest shadow area of the picture—that is the brightest part of the image. If this light value and the

speed of the printing paper are known it is a simple matter to determine the enlarging exposure needed—a calculation carried out by the scales on the photometer.

There is no doubt that such devices are helpful particularly when large numbers of enlargements are being made from widely differing negatives, but for the highest quality work there is still nothing to beat the test exposure method. One difficulty from the amateur's point of view is that he buys his paper in small quantities and the speed of printing papers varies greatly from batch to batch. Careful preliminary tests are needed for every make, grade and batch of paper used before reliable results are possible with any kind of photometer.

It will be realised that the exposure time indicated by a photometer is that needed to yield just a full black for the shadow tone measured. If the paper matches the negative, this exposure time will also ensure that the highest light will be a tone just removed from white and the enlargement will be, technically, a good one—but not necessarily the best from the pictorial point of view. Furthermore, the exposure scale of the printing paper rarely matches the negative range exactly, and modifications of the indicated exposure time may be needed in order to give a satisfactory print.

The greater part of this chapter has been devoted to the making of test exposures, choice of paper grade, and so forth. If these matters are understood and carried out correctly, the making of the final print is perfectly straightforward. All that has to be done is to expose a full sheet of paper for the time determined so carefully and under the same conditions as for the test. The result will be a good, straight print. It may not be the best the negative can give ; improvements may be possible by shading and printing up—dodges which are dealt with along with others in the chapters that follow. It can be said, quite safely, that there are few negatives that do not require one or other of the simple control methods during enlarging for the best result.

Chapter 4

FINER POINTS OF ENLARGING

SHADING is a valuable method of control and consists of curtailing the exposure given to parts of an enlargement by interposing a sheet of card or other opaque material between the enlarger lens and the printing paper. This device is used chiefly where a shadow area prints too dark in a straightforward enlargement. Printing up is essentially the same as shading but it is done for a different reason—to give extra exposure to areas which print too light.

Shading Devices

A few simple gadgets are needed for shading and printing up; discs of various sizes cut from thin black card and stuck with adhesive tape on the end of thin but stiff wires; some pieces of thin black card or stiff paper, and a lump of ' Plasticine ' that can be moulded to any desired shape, stuck on the end of a piece of wire for shading an area of awkward shape.

When, in a straight print, an area such as a rock or bush in the foreground of a landscape is too dark, shading can effect a great improvement. Unless the area is a clearly defined one it is likely that one of the discs on a wire can be used successfully. It is held so that a shadow is cast over the area that prints too dark for a proportion of the exposure time—but for precisely what proportion has to be determined by experiment.

Avoiding Hard Lines

To avoid a hard and obvious line between the shaded area and the rest of the enlargement, the shading device must be kept on the move all the time it is in use. Nothing looks worse than obvious shading in a picture and the majority of failures

can be attributed to not having kept the shading device moving vigorously enough, and to shading for too big a proportion of the exposure. A considerable amount of practice is needed to acquire proficiency in shading but it is a skill well worth cultivating.

It will be discovered quickly that the nearer the shading card is held to the enlarger lens the softer the edges of the shadow it casts, and it may be tempting to hold it very near the lens in order to avoid a hard line. But if it is too near it

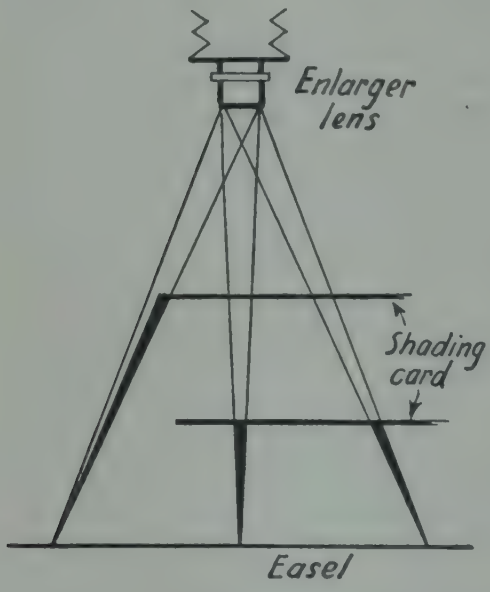


Fig. 23

Here can be seen the effect of holding a shading card too near the enlarger lens. Although the shadow it casts will be very soft, the card partly obstructs the light from the parts of the image it is not desired to shade.

will be found that not only is the light being held from the part being shaded but the rest of the image is also reduced in brightness (see Fig. 23). The card should be held a little nearer to the paper than to the lens ; a ratio of about 1:2 is about right. For very sharply defined areas the card should be held rather closer to the paper so that shadow is fairly sharp, but this must not be overdone.

Special Shading Shapes

An area which cannot be shaded by means of a disc because of its shape must have a card cut specially for it. As it will be

held at some distance from the printing paper it must be smaller than the area on the easel. When tracing the shape on the card therefore, the latter should be supported on a pile of books in approximately the same plane in which it will be used. There is no need to follow precisely an intricate outline ; only an approximate shape is wanted. An alternative to cutting a shape from card is to use a lump of ' Plasticine ' moulded roughly to conform with the area to be shaded. For the same purpose a wad of cotton-wool pressed to shape will often be found useful.

An area at the edge of a picture can be shaded by means of the hands. It is amazing what complicated shadows can be cast by holding the hands and fingers in various positions, and professionals often manage with no other device except for specially difficult jobs.

Printing Up

The same techniques can be used for printing up : an operation often required to get the best out of a negative. For example, a sky may print as nearly white paper in a straight enlargement—a most undesirable tone for any sky. A sheet of card with one of its edges cut to conform fairly closely to the skyline of the projected image can be used to give the sky area sufficient extra exposure to make it an appropriate tone of grey. This often reveals unsuspected clouds in the sky particularly if the negative is rather dense through over exposure.

Correcting Uneven Illumination

One of the most valuable uses of printing up is for evening up a print from an uneven negative, or for correcting uneven illumination in the enlarger. It is a fairly common experience to make an enlargement only to find that it is lighter at one end than the other or a little lighter in one corner. The correction of such minor faults is very easy—the hands are usually suitable for shading of this kind—and it makes a world of difference to the finished picture. With practice it will be found that careful inspection of the image on the easel will reveal unevenness that requires correction.

Obtrusive Highlights

It is often necessary to print up an area that is too light in a straight enlargement. For example, the wall of a white building near the edge of a photograph may tend to lead the eye out of the picture. Printing up the wall to make it somewhat removed from pure white may help the composition considerably and may also reveal hidden texture of the stone. Tone correction done photographically is generally more effective than the same thing done by handwork on the finished print.

Darkening Corners

Another very simple dodge which may improve an enlargement is to darken the corners a little by printing them up. This helps to keep the attention to the middle of the picture where lies generally the main point of interest. One of the discs of card on a wire does this job very well, but care is needed to grade the general tone of the print from light to dark without a sudden jump which will make the device obvious and look artificial.

It would be possible to talk about shading and printing up almost indefinitely, but when once the simple technique of the business has been mastered it is up to the individual to develop its use to produce the effects required in an enlargement. Therein lies much of the art of photography.

Exposures when Shading

An important point concerns the exposure times when shading and printing up. For how long must an area be held back, or how much extra exposure is required when printing up? The beginner is advised to settle these questions by means of small additional test strips but some guidance can be offered. If an area is much too dark in a print it is useless to reduce the exposure given to it by anything less than 25 per cent. and a 50 per cent. reduction may not be excessive. To shade for about 10 per cent. of the total exposure time as many beginners do to begin with, is sheer waste of time, as a few experiments will show. Similarly, when printing up, the area being treated may require twice as long an exposure as the rest of the picture.

The contrast grade of the printing paper influences the relative exposures needed. The shorter the exposure scale of the paper, that is, the greater its contrast, the smaller the exposure increase or decrease required for a given increase or decrease in density. It will be noticed in fact, that when using a hard grade of paper all exposure times are critical and shading and printing up are tricky. That is one of the reasons why the photographer should aim at producing negatives of a contrast suitable for normal or soft grades of paper.

Improving Tone Reproduction

An important application of shading and printing up is in overcoming the deficiencies of the photographic process as regards tone reproduction. We have seen in a previous chapter that even a glazed glossy print can exhibit a brightness range of no more than about 50 to 1. This means that a subject of high contrast with a range of 200 to 1 has to undergo some distortion when printed. Several alternatives present themselves ; we can compress the shadow tones and accept the resulting lack of gradation in them ; we can compress the highlights and let them print as pure white paper—rarely a satisfactory procedure ; or we can compress the tone scale as a whole and put up with the rather flat effect. Often we may resort to more than one of these devices at the same time in order to secure the most pleasing effect.

There is a very common type of subject which lends itself to special treatment. This is the high contrast scene which contains a collection of interesting shadow tones, a number of light tones with a big gap between these two groups, there being few or no half-tones. Many such subjects spring to mind ; the sunlit scene viewed through a dark archway, a distant landscape framed by a nearby tree ; an interior of a room with a view through the windows and so forth. Negatives of subjects of this kind will naturally have a big overall density range such as necessitates a soft grade of printing paper as a general rule. But a print on soft paper may be unsatisfactory because of the inevitable compression of the tones in the highlights and shadows. Prints of such a subject are shown on page 95.

If we use however, a harder grade of paper and hold back the shadows by careful shading we can secure adequate contrast in the light and dark tones and thus produce a more

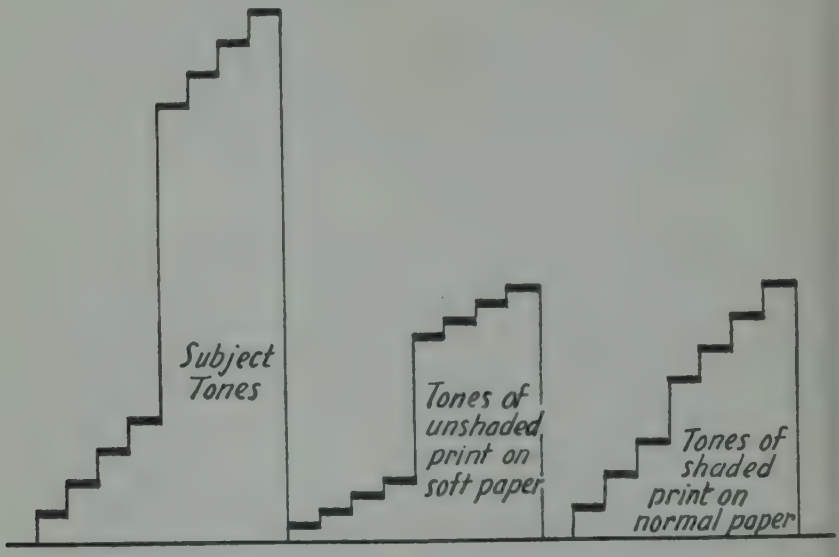


Fig. 24

Here is shown diagrammatically the situation when one is enlarging a negative consisting of a group of important shadow tones, some essential highlights, but practically no half-tones. A straight print on soft paper is likely to be less satisfactory than a carefully shaded print on a harder grade of paper. A typical example of this kind of subject is reproduced on page 95.

pleasing enlargement. What we have done is to reproduce the dark and the light tones of the subject with reasonable correctness as regards contrast but we have narrowed the gap between the two main groups of tones; an effect that the eye accepts without protest. In Fig. 24 the procedure is shown diagrammatically to make it quite clear.

Chapter 5

FAULTS IN ENLARGEMENTS

It is not the intention of the authors to add interminable dreary pages dealing with obvious faults that the veriest tyro can diagnose and prevent in future work, but there are certain defects which can ruin an enlargement and of which it is not always easy to find a cause.

"Muddy" Enlargements

A defect, often so slight as to pass unnoticed by the inexperienced, is that of flatness or 'muddiness' caused by scattered white light falling on the printing paper during exposure. Such scattered light can come from various places:—

(1) A not too light-tight enlarger.

(2) Small chinks in the blackout arrangements of the printing room,

(3) Scattering of light by the enlarger lens.

Some enlargers are badly designed from the point of view of light-tightness of the lamphouse and negative carrier. Pencils of light escape here and there and may be reflected from nearby light coloured surfaces on to the paper. It is helpful to pin sheets of black paper on walls near the enlarger so that any escaping light is absorbed instead of reflected, but the real remedy is to improve the light-trapping arrangements of the lamphouse. This is a job for the expert; badly done, the ventilation of the lamphouse will be impaired and overheating will result. It must not be assumed that a tiny chink of light just visible from a ventilation hole is causing trouble; it generally has to be a fairly bad leakage to cause detectable degradation of an enlargement.

Testing for Light Leaks

A simple test will show whether or not there is enough scattered white light falling on the enlarger easel to impair the quality of prints. Make an enlargement from a negative showing plenty of delicate highlight gradation, and stopping the lens down sufficiently to require an exposure rather longer than usual. Now make a second enlargement but this time with the enlarger lamphouse shrouded with a black cloth. If the second print shows better highlight gradation than the first then it is certain that white light in dangerous quantities is falling on the paper from the lamphouse. It is not feasible to cure this trouble by keeping the lamphouse covered, owing to the lack of ventilation but it can be done as a temporary expedient.

A test for general white light in the printing room due to imperfect blackout arrangements is to turn out all the lights in the room including the lamp in the enlarger, and to place a sheet of fast bromide paper on the easel, leaving it there for about twice as long as the longest exposure likely to be given when making an enlargement. Upon developing the paper in the normal manner it should be found to be quite free from fog ; any sign of developed silver indicates light from somewhere. If a piece of black card is laid over part of the paper while it is being 'exposed' the slightest fogging will be easily detected.

Lens Flare

Every image projected by a lens is degraded by an overall flood of light called 'flare light'. This arises from many causes ; it comes from reflections between the glass-to-air surfaces of the lens ; from any bright metal inside the lens mount or on the leaves of the iris diaphragm, and from minute bubbles or other defects in the glasses of which the lens is made. In a camera, flare light flattens the shadow gradation and unless this flattening is very marked it is not very important. In the enlarger it is the gradation of the highlights which is flattened—a far more serious defect, for good highlight gradation is essential for high print quality.

Reducing Lens Flare

The coating or ' blooming ' of lens surfaces which is widely practiced, greatly reduces flare caused by reflections between the glass-to-air surfaces, but it can do nothing to reduce flare from other sources. In a good lens and one which has not developed any patches of bright metal within the mount, the flare from other sources should be negligible provided that all the surfaces of the lens are scrupulously clean.

It is far from generally appreciated that the merest film of dust, the smallest greasy fingermark, or a hint of condensed moisture on one or other of the lens surfaces adds greatly to the flare light and leads to marked deterioration in print quality by causing muddy highlights without sparkle. For this reason it is essential to clean the enlarger lens very carefully before every session of enlarging, using proper lens-cleaning tissue for the purpose. Never use any harsh material for cleaning the soft—yes, *soft* glass of which lenses are made. Repeated use will give rise to innumerable tiny scratches which are highly efficient in increasing permanently the amount of flare.

As no lens is perfectly free from flare it is important to take all practicable steps to keep it as small in amount as possible. Always mask out with black paper all but the area of the negative to be included in the enlargement. This point is far too often neglected, with disastrous results. If the photographer has to smoke while enlarging, care should be taken not to puff smoke through the cone of light from the lens—however pretty may be the effect! These simple precautions are always important but they are particularly so when enlarging a negative containing a large shadow area close to a highlight area full of delicate detail. Scatter by the lens may cause the light from the shadow to ' spread ' into the highlights making them muddy.

Unsharp Enlargements

Lack of definition in an enlargement is a bad fault and is often difficult to track down because of the many things that can cause it. We can rule out such obvious points as errors in

focussing, a poor lens and so forth, and deal with the less obvious ones. Careful study of an enlargement will often show that while it is critically sharp say at one end as can be seen by the crisp rendering of negative graininess or tiny defects, the definition gradually falls off towards the other end. Such falling off of sharpness is nearly always due to lack of parallel-

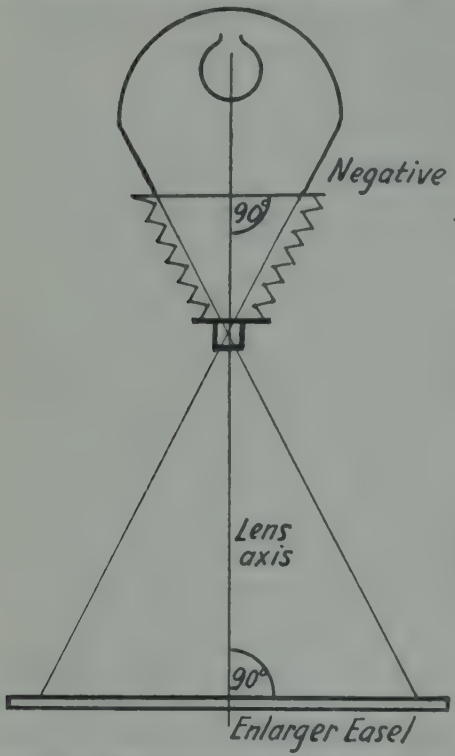


Fig. 25

An essential condition in every enlarger is that the negative should be at right-angles to the lens axis and the easel at right-angles to the lens axis. The only exception to this is when one is correcting distortion in the negative such as converging verticles of a building.

ism between the negative and the printing paper on the easel. An essential condition for good overall definition is that shown in Fig. 25. Negative and paper are parallel and the axis of the lens is at right-angles to both. Any inaccuracy means lack of sharpness somewhere in an enlargement unless the lens is well stopped down.

A flimsy enlarger probably starts its life good and square in every respect but may develop defects later with use. The support of the enlarger on its column may droop, the lens panel may sag, and other defects can arise. The only certain remedy is an overhaul by the makers of the instrument.

Buckling of Negative and Paper

Patchy definition can be caused by buckling of a film negative or the printing paper or both. The negative is the more likely culprit. It must be confessed that the only real remedy for buckling films is to sandwhich them between two pieces of glass and to ignore the risk of dust and resultant white spots on enlargements. Buckling of the printing paper would be clearly visible if it is sufficient to cause noticeable loss of sharpness. A well-made masking board will hold even the largest sheet of paper flat as a general rule. A sheet of perfectly clean glass free from scratches or flaws can be laid on top of a sheet of paper which does persist in buckling perhaps because of distortion during the final drying process of manufacture.

Vibration

Quivering of the enlarger during an exposure will produce blurring which may look like ordinary unsharpness at first sight. It is most likely to happen with a vertical enlarger when the lamphouse is right at the top of the column. The enlarger should be used on a substantial bench or table with a thick rubber pad beneath the easel to absorb vibration of the building caused by passing traffic and the like. The impatient photographer is urged to cure the habit of pacing the room during lengthy exposures and it goes without saying that the enlarger should never be touched while an exposure is in progress.

Other Faults

There are, of course, a multitude of defects that can occur in enlargements apart from those discussed in the foregoing paragraphs. To help the photographer who is not too familiar with them, and to help him diagnose them should he be unfortunate enough to encounter some of them, the following table has been compiled.

FAULTS IN GLAZED PRINTS

FAULT	APPEARANCE	POSSIBLE CAUSES	PREVENTION	REMEDY
Prints stuck to glazing surface.	—	1. Dirty glazing surface. 2. Glazing glass cleaned with strong acid or alkali. 3. Use of excessive heat during drying. 4. Print emulsions very soft. 5. Prints taken too long to dry in damp place.	1. Clean and polish surface thoroughly. 2. Use only water followed by french chalk. 3. Use only cool draught. 4. Use acid hardening fixing bath or glazing solution. 5. Dry in warm room.	Soak glazing sheet and print in water for at least one hour. Peel prints off cautiously.
Fleck marks.	Unglazed patches which are clearly visible when print is viewed obliquely.	1. Print drained of water before laying on glazing sheet. 2. Squeegeeing not hard enough or squeegee uneven. 3. Print emulsions excessively hardened.	1. Use plenty of water when laying prints down. 2. Use heavy pressure and a good squeegee. 3. Soak extra hard prints in water at 70° - 75° F. for 10 minutes before glazing.	Soak prints in water for 15 minutes and reglaze.
Grit marks.	Tiny dimples in print surface where emulsion has no glaze. Piece of grit or other foreign matter embedded in each dimple.	1. Water supply or dishes dirty. 2. Room dusty or window open on to gritty road.	1. Fit filter to tap. Use clean dishes. 2. Make sure of perfect cleanliness in work room.	Soak prints in water for 15 minutes; swab surfaces hard with viscose sponge, and reglaze.
Oyster shell markings.	Print surface has more or less concentric ridges, reminiscent of the inside of an oyster shell.	1. Print dried too quickly. 2. Print emulsion too hard. 3. Squeegeeing not hard enough.	1. Dry more slowly. 2. Soak prints in tepid water before glazing. 3. Squeegee firmly. 4. Lightly smear extreme edges of backs of prints with 1 part glycerine and 5 parts water before drying.	Soak prints in water for 15 minutes and reglaze.
Scum marks.	Glazed surface marred by white scum.	1. Scum deposited from chalky washing water.	1. Swab each print emulsion before glazing.	Soak prints in water for 15 minutes; swab emulsions hard, and reglaze.

	FAULT	POSSIBLE CAUSES	PREVENTION	REMEDY
DEFINITION	Image completely unsharp.	1. Negative unsharp. 2. Careless focussing. 3. Focussing mechanism slipping. 4. Poor enlarging lens.	1. — 2. Always check image for sharpness before exposing. 3. Check focussing mechanism for slackness. 4. Test lens of enlarger.	
	Image not sharp at edges.	1. Film negative bowed in glassless negative carrier. 2. Lens defective. 3. Paper not flat on easel glasses.	1. Fit carrier with two thin glasses. 2. Stop lens down one or two stops before exposing. 3. Flatten paper before exposing.	No remedy for an unsharp print.
	Image sharpness falling off towards one side of print.	1. Negative and easel not parallel. 2. Lens panel bent.	1. Check enlarger for squareness. 2. ditto.	
	Image blurred.	1. Paper or negative moved during exposure. 2. Enlarger knocked during exposure. 3. Vibration due to heavy traffic.	1. Make sure negative and paper are secure. 2. Avoid touching enlarger. 3. Stand enlarger on thick rubber mat.	
GRADATION	Print too grey and lacking in contrast.	1. Too soft a grade of paper used. 2. Development too short. 3. Developer exhausted. 4. Developer temperature too low.	1. Change to harder grade of paper. 2. Develop always for 2 mins. 3. Do not overwork developer. 4. Check developer temperature with thermometer.	Intensify with chromium intensifier.

	FAULT	POSSIBLE CAUSES	PREVENTION	REMEDY
	Print too light in tone.	1. Exposure insufficient. 2. Print left for much too long in fixing bath.	1. Give increased exposure. 2. Fix for no longer than 15 minutes.	Try intensification.
	Print too hard and contrasty	1. Too hard a grade of paper used.	1. Use softer grade of paper.	No remedy.
STAINS	All-over yellowish or brownish stains.	1. Excessive development. 2. Developer too warm. 3. Developer contaminated with hypo. 4. Fixing bath exhausted or not sufficiently acid. 5. Stale or badly stored paper. 6. Insufficient rinse between developing and fixing.	1. Develop for only 2 minutes. 2. Check developer temperature with thermometer. 3. Discard developer and replace with new. 4. Replace fixing bath with fresh. 5. Try developer improver. 6. Use acid stop bath in place of plain water rinse.	Try stain removing bath.
	Patchy yellow or yellow - brown stains.	1. Print not fully covered with developer throughout development. 2. Print allowed to cling to others in fixing bath. 3. Print not completely covered with fixing solution particularly during first few minutes of fixation.	1. Use plenty of developer and rock dish constantly. 2. Move prints about frequently during fixing. 3. Agitate print for first minute in fixing bath.	Try stain removing bath.
	Yellow and yellow-brown stains develop after few weeks or months.	1. Incomplete fixation. 2. Incomplete washing.	1. Use two bath fixing technique (see page 68). 2. Check up on washing facilities and test prints for hypo (see page 71).	Fix again and wash thoroughly

	FAULT	POSSIBLE CAUSES	PREVENTION	REMEDY
	Print too dark.	1. Over-exposure.	1. Reduce exposure time.	1. Reduce with Farmer's reducer.
	Print muddy and flat with greenish tones.	1. Over-exposure and under-development.	1. Reduce exposure time and develop fully.	1. Try gold toning.
FOG	Print fogged all over.	1. Paper old or badly stored. 2. Safelights not safe. 3. Paper exposed to white light inadvertently. 4. Developer too warm or incorrectly compounded.	1. Change paper for fresh or try developer improver. 2. Check up on safelighting. 3. Keep paper well protected. 4. Check temperature and change developer if necessary.	Slight fog can often be cleared with Farmer's reducer.
	Print image fogged; borders clean.	1. Scattered white light from enlarger lamphouse. 2. Dirty enlarger lens.	1. Paint walls near enlarger black or cover with black paper. Check lamphouse for light leakage. 2. Clean lens.	Farmer's reducer may help.
	Print shows patches or streaks of fog.	1. Packing of paper not light-tight.	1. Keep paper in lightproof drawer.	Local reduction with Farmer's reducer will remove light fog.
	Uneven or mottled image.	1. Paper not covered with developer quickly enough.	1. Use adequate quantity of developer in dish. Use of wetting agent assists rapid wetting of emulsion.	No remedy.

	FAULT	POSSIBLE CAUSES	PREVENTION	REMEDY
WHITE SPOTS	Irregular shaped white spots of various sizes.	1. Dust on negative. 2. Dust on printing paper.	1. Clean negative and carrier glasses carefully. 2. Tap printing paper gently on edge of bench before exposing. Dust printing room thoroughly.	Spot with spotting medium or dye.
	Irregular shaped white spots, but not clearly defined.	1. Dirt on surface of condenser nearest negative or on diffusing glasses in diffused light enlarger.	1. Clean condenser or diffusing glasses.	Spot with spotting medium or dye.
	Circular white spots of varying size with soft edges.	1. Airbells adhering to print during development.	1. Wipe surface of paper with fingertips when first in developer. Use wetting agent in developer.	Spot with spotting medium or dye.
DARK SPOTS	Dark, sharp spots.	1. Pinholes in negative. 2. Dry chemical dust settling on paper before development.	1. Spot negatives before enlarging. 2. Keep dry chemicals out of printing room.	Remove with retouching knife or by chemical reduction.
	Dark, roughly circular patches of various sizes.	1. Air bubbles trapped beneath face-down print in fixing bath allowing development to continue.	1. Agitate prints in fixing bath for first minute.	Refix and wash print. Remove marks by local reduction.
	Dark and light rings. (Newton's rings).	1. Excessive pressure on negative from glasses between which it is sandwiched or from lower surface of condenser where this serves to hold film flat.	1. Decrease pressure. 2. Make sure film is bone dry.	Light rings can be darkened by spotting to make defect less noticeable.

Chapter 6

CREATIVE ENLARGING

It will have been gathered from the earlier chapters that enlarging, whilst demanding certain essentials, is a straightforward process the success of which is largely proportional to the quality of the equipment and directly to the care and skill with which it is put to use. Very little practice is sufficient to make a good, straight enlargement of what is known as 'commercial quality'. Such a photograph will present good definition, adequate detail in highlights and shadows, general brightness and freedom from stains and blemishes. In short, it will be a good photographic representation of its subject and, in consequence, will be acceptable not only to the photographer but to the client who commissioned its production.

To make such an enlargement by perfectly straightforward means, we must regard as our first essential, a perfect negative. This will have received correct exposure, development appropriate to its subject range, and its extremes of density will lie within the compass of the selected printing paper. To the beginner, this criterion may sound so precious a jewel as to be almost impossible of attainment. The truth is, of course, that of every ten negatives made by the trained professional and the advanced amateur, nine will probably qualify as perfect. With absolutely straight printing they will yield first-rate enlargements which merely indicates that their makers have mastered photographic technique. The whole point lies in the undoubted fact that from an aesthetic angle, there are few technically perfect prints, which cannot be improved by some departures from straightforward treatment. This was seen in Chapter 4, in our discussions of shading and printing-

up. An important shadow may be rendered satisfactorily dominant by a little more local exposure ; a sense of depth may be lent by slight under-exposure of the far distance. Printing-up and shading are now so much a part of enlarging technique that they no longer qualify as 'refinements' and are mentioned here rather as examples of deviation from the straight though far from narrow path of enlarging.

There are many tricks and dodges available to the seeker after perfection and whatever the extreme school of pure photography may declaim, there seems to be a legitimate use for them all. True, there are advertised adjuncts to enlargement which leave one poised on the brink of the old, old question, 'Is this photography or is it mere emulation of a graphic art?' Such heart-searchings must remain a matter for the taste—and the artistic conscience—of the individual, and the present authors have no intention of becoming embroiled in so controversial a subject. It is our concern to cover those modifications to the enlarging process which, by emphasis or subordination of tone or detail, mark the difference between a pure photographic record and an artistic achievement. In discussing so-called control methods, we are here, naturally, concerned only with those which take place during the actual exposure of the print.

Diffusion

To begin by stating baldly that 'diffusion' and 'out-of-focus' are not synonymous terms may sound redundant to some ; yet this particular fact is by no means generally recognised. If, when taking a photograph, the lens is not exactly at the right distance from the film—and focussing is a critical business—part or possibly the whole of the picture will be unsharp or 'out-of-focus'. If, however we focus carefully and then place on the camera lens some device for scattering the light-rays, the definition of the whole picture will again be unsharp but in a different and far more pleasing way than when it was merely 'out-of-focus'. Undoubtedly, the best method of applying diffusion is to do so when exposing the negative. Light is then scattered in such a way that it is

spilled from the highlights into the adjacent shadow areas and, on the finished print, appears in the form of a pleasant halation with a softening of the contrasts.

If, however, the negative is made sharp, any diffusion subsequently required must be applied by fixing our light-scattering device over the enlarger lens. In this case the final effect is not quite the same. Light is spilled from the bright areas of the negative image on the printing paper but since these bright areas are the shadows, the ultimate effect will be that light is spilled into the highlights. Whereas with camera diffusion the spilled light prints as a kind of white or light-toned fringe, it now appears as a dark one. This may sound undesirable although in actual practice enlarger diffusion can be very effective indeed. The screens for the purpose may be purchased or contrived ; it is possible to buy special diffusing screens to fit over the lens of camera or enlarger and in various types to give a greater or a lesser effect.

If it is preferred to make one's own, there are a variety of materials which may be used, including muslin, silk-cloth, crumpled ' Cellophane ' or even a piece of glass on which concentric circles have been smeared with grease. Since diffusion is always best controlled, perhaps the best of the self-contrived screens are those made from silk or bolting-cloth. This may be obtained in varying degrees of fineness, although Nos. 20 to 60 (which means that the cloth has that number of threads to the linear inch) should cover every photographic requirement. Dyeing the cloth black will very slightly decrease the diffusion effect. A very complete array of diffusion discs for enlarging will consist of no more than three, in Nos. 20, 40 and 60. If these are made up in the form of the old-fashioned lens-cap for fitting over the enlarger lens, they will provide, in convenient form, slight, average, and considerable diffusion, the greater degree resulting from the cloth of the highest number. It will be found that printing exposures must be increased by about 50 per cent. when using the finer screen. It is not necessary to employ diffusing screens throughout the whole exposure, particularly when the fine-mesh or ' maximum effect ' screen is in use. An excellent

rendering may be obtained by exposing for about one-quarter of the total time without the screen, this being slipped over the lens for the remaining three-quarters. This procedure gives the desired softening of the image whilst still retaining sufficient of the original sharpness to produce an artistically satisfying result. An important point to remember in connection with diffusion is that the contrast is quite definitely reduced. If it is desired to preserve the original contrast whilst at the same time gaining the effect of diffusion, it will be necessary to make the print on a harder grade of paper.

Before leaving the subject, it should be pointed out that not all pictures are improved by the use of diffusion. It is, of course, a favourite and valuable device in ' glamour ' portraiture and is also of assistance in the subordination of unwanted negative grain. One of our finest landscape photographers has developed his own use of diffusion into what is almost a personal trade-mark and, in his expert hands, the effect is, no doubt, a thing of beauty. But like all good things, it must be used with discretion. The mere possession of the apparatus is no excuse whatever for surrounding one's entire output with a nebulous aura which merely irritates where it was intended to charm.

Distortion

No matter how excellent the camera nor however skilfully it is manipulated, unless the instrument is provided with a rising front, distortion will sooner or later rear its grotesque head. Even with near-perfect apparatus like the modern miniatures or the twin-lens reflexes, there is no method of photographing a tall building from ground level without inevitable convergence of the verticals. Fortunately, a great deal can be done in the enlarging process, whether or not the enlarger embodies special provision for correction. If, when we made the negative, we have unavoidably introduced distortion, we can still remedy matters by deliberately applying counter-distortion during enlargement.

On many enlargers, such as the Envoy, for instance, the entire optical system, including the negative carrier and

lamphouse is capable of such movement that the axis of the lens is no longer at right-angles to the baseboard. In others, the negative carrier may be set out of its normal horizontal plane, the ultimate effect being somewhat similar to that in the previous example. And where no such rearrangement of optical system or negative carrier is possible, we can always fix the enlarging desk itself in a compensatory plane and still achieve our object. Whichever method is used it is only necessary to juggle the angle either of negative or printing paper until the converging uprights are once more truly vertical. When this has been done it will be noticed that, with the lens at its widest aperture, the image is no longer sharp over its entire area. Having focussed sharply at the centre of the picture, stop down the lens until overall sharpness is attained. Exposure will naturally be longer but the rectification of those Pisa-like buildings will be cheap at the price. On page 153 you may observe how correction of distortion has improved out of all recognition a photograph of the Manchester Public Library in which, through the absence of a rising-front, the verticals fell away towards the sky. In this example, too, we have made use of other devices to which reference will be made in due course.

The picture on page 98 illustrates a further use for these movements in the enlarger although, in this instance, we have applied the reverse technique and have purposely introduced distortion to produce a different result from that contained in the original. The subject of this portrait possesses a roundish face which, in our opinion, is anything but unattractive. Its owner, however, decided that it was much too round and could anything be done about it?' It was a very simple matter to apply a little dark-room plastic surgery by arranging the bromide paper at an angle, so that the consequent slight elongation of the head compensated for the fullness of the face. Had the face been too long, correction would have entailed tilting the paper in a lateral direction.

It goes without saying that extreme care must always be exercised in the use of this particular dodge. The slightest tendency to overdo the angle, either of negative or of paper,

will exaggerate the effect until the subject is difficult to recognise. Remember that in raising the bromide paper, the side which is finally nearest the lens will carry a smaller image than that on the opposite side.

We have, then, a method of minimising a too-prominent forehead or a too-obtrusive lower jaw, the reverse being equally true. It may be that, on occasion, you will be asked to produce something exciting in the way of deliberate distortion and when this happens, you can really spread yourself. A quite passable imitation of the kind of thing you see in a fun fair Hall of Mirrors may be obtained by fixing the bromide paper with a very definite hump down its middle or, indeed, in any part of its area. This will add distortion with a vengeance but if you are handling a portrait in such a manner, take care that its owner is fortified with a sense of humour before showing him the result. Devices of this description are not included with the idea that an alternative title to this book might be ' Fun with an Enlarger '. These things are stunts, but it is surprising how even the wildest of stunts may be put to use in a perfectly serious composition. It is vitally necessary, however, to label them plainly, ' Handle with Care '

Flashing

We have already seen how, by printing through a small hole in a card, local areas of a print may be given additional exposure, a process sometimes known to photographers as ' burning-in '. Useful as the dodge undoubtedly is, it does not always provide the correct answer to the problem in hand. Quite frequently, an otherwise excellent print is marred by a small but intense light, perhaps near the edge of the picture, and no amount of local exposure will get rid of it. Possibly, the offending highlight will be a glaring TEAS sign on the wall of an otherwise delightful thatched cottage ; or a too-dominant milestone in the one portion of a landscape where it should not occur. In such cases, mere burning-in is quite likely to accentuate the detail in the sign or milestone if the negative is at all dense in that portion and the eye-distracting white will still be much in evidence. Here, the

solution is to be found in ' flashing ' or in adding a second, carefully controlled exposure to the local area and to that only. It is best carried out in the developing dish, as soon as the image has appeared sufficiently to allow recognition of the portion to be flashed. A small pencil type of flashlight is suitable for the purpose, provided that all but a minute area of the bulb has been obscured by adhesive tape or paper. Immediately the image is far enough advanced in development, the flashlight should be held a few inches above the paper and its light directed on to the part you wish to darken. The light must be kept moving, just as in shading during enlargement and a little bromide paper sacrificed to experiment will yield much ultimate benefit. Carried too far, the flashing of a troublesome highlight will produce a worse result than before, so that it is as well to know just what may be expected from, say, 3 seconds flashing at 3 inches from the paper.

In order to be successful flashing should be carried out very early in development. To delay doing so until the print is three parts developed will result in the flashed portion being hopelessly under-developed, with a noticeable difference in colour in the final print.

Flashing, as compared with additional local printing will quite definitely smother detail in the part flashed and in this respect alone, is often useful. If it is desired to darken part of a print whilst still retaining the underlying texture, flashing is not the ideal method and local printing exposure is a better remedy. Flashing can be applied where darkening of the corners is desired and, taken all in all, is a very handy tool to have about the darkroom.

There is on the market, an excellent flashing device known as the Nebro "Photo-Stylo". It is constructed and handled much like a pencil and is equipped with a variable rheostat for dimming the light. There are three attachments for varying the size of the beam from a widely diffused flood to an extremely fine point for detail work.

A further use for flashing is to be found in the adding of borders. In exhibition work, it is quite usual to arrange, where the subject warrants, a thin black border around light-

toned prints, high-key portraits being often improved by this means. This may be done by holding down a straight-edged card on the exposed but not yet developed print, allowing the required margin of paper to protrude. The enlarging light, without the negative in position, is then switched on for a second or two, each of the four edges being treated similarly. Referring to 'Bubble Fantasy', (page 155), it will be noted that the picture is surrounded by a shaped border, representing the proscenium curtains and pelmet of a stage. This effect merely required that the greater part of the picture was protected from the flashing-light by an appropriately shaped card.

Texture Screens

These provide a means for imparting to an enlargement the effect of a grained surface, a steel engraving or even of an oil-painting, complete with brushmarks. They are placed in close contact with the printing paper at the time of enlargement and must, consequently, be of the same size as the print. In order to obtain the full effect, they are best held in position on the paper by means of a clean sheet of plate-glass, so as to avoid possible fuzziness due to imperfect contact between screen and paper. Since the screens are actually photographic negatives they demand careful handling, for any accidental blemishes will show as clearly as the effect for which they are designed. There is no doubt that their judicious use does frequently enhance the effect of certain types of photography but, here again, their application must be left to the operator and his artistic conscience. In reporting bare facts, we must add that the addition of a texture screen will cause the exposure to be increased by about $2\frac{1}{2}$ times.

Chapter 7

COMBINATION PRINTING

It is our aim at this point to show how two or more negatives, either whole or in part, may be combined in one print, not with intent to deceive but to produce a more aesthetically pleasing picture. No doubt we risk the revival of what will always be controversial among the various schools of photographic thought. One of the loudest voices we ever heard raised against this ' Misuse of photography ' came from an eminent worker in bromoil who, be it noted, had not the least compunction in mixing two distinct arts ; and the practise of bromoil surely does demand such a mixture. Nobody nowadays questions the legitimacy of printing in a more suitable sky, so why not a new foreground or background if, in the mind of the worker, the result justifies the means. However, to those for whom the sky's the limit, there is still much to be done and even so simple a composite printing operation is the better for attention to detail.

Printing-in Skies

If a landscape photograph is to be genuinely improved by this means, the new sky must be carefully selected from two viewpoints—the aesthetic and the technical. Presumably the modification is to be made because the original sky is (a) completely bald or (b) inconsistent with the general mood of the picture. The fine weather type of cloud, reminiscent of tufts of cotton-wool, may be very much in tune with a pastoral scene but sadly incongruous as the upper portion of a rough sea study. If crashing waves are to be the main theme of our picture, any noticeable sky must be of a similarly dramatic nature and should be chosen accordingly.

Lighting, too, is important and the superimposed clouds must be lit from approximately the same direction as the main portion of the picture. Lack of attention to this point will induce, even in the uninitiated, a sense of something wrong. After all, where an otherwise suitable negative is found wanting in this respect, there is no reason why it should not be reversed in the enlarger. Most pictorialists make a point of collecting interesting or unusual sky negatives but where the right thing appears not yet to have been discovered, the happy choice may be found lurking among one's stock of landscape negatives. Whichever the case, it is well to observe the second viewpoint and to ensure that the two negatives are reasonably close in contrast, for too great a variance is just another way of inviting adverse criticism. If the foreground is flat and the ideal sky contrasty—or vice versa—the only way of bringing them into line on the print is by using one of the variable contrast papers, such as Multigrade or the American Varigam. The fact that no highly elaborate apparatus nor abnormal skill is necessary when replacing a sky should not delude the operator into anything approaching 'slip-shoddiness'.

The carelessly executed composite print will always advertise its artificial origin and a little extra care and thought is a wise expenditure. The average person does not appear to take this kind of deception very seriously until it is deliberately thrust into his consciousness by bad technique. Then, of course, his ego is stung by so blatant an insult to his intelligence.

The process itself is simple. The foreground portion of the picture is printed first and if the original sky is sufficiently dense, there will be no need to protect the corresponding part of the printing paper during exposure. If however, the negative has been made with a filter or, for some other reason, the sky is thin, it will be necessary to prevent its image from printing through, even to a slight degree. This is not difficult to arrange. One cuts a piece of card so that its lower edge corresponds roughly to the skyline and holds it a few inches above the paper, thus withholding exposure except in the

foreground. The card must be kept gently moving—a slightly rotary motion is best—during the whole time the enlarger lens is uncapped. Neglect of this precaution will result in an all too clearly defined line when the print is developed. It will quickly be found that the closer to the bromide the card is held, the sharper will be the edge of its shadow, this effect increasing as the lens is stopped down.

Having printed the foreground, the negative is changed in favour of that bearing the chosen sky. With the orange safety-glass over the lens, the sky negative is moved about into the most favourable position and in this connection some kind of guide is desirable. Using a very soft black pencil, a series of small dots may be placed at salient points of the image, on the bromide paper itself. These may be easily rubbed off with the finger-tip immediately the paper is wet in the developer. The dots will serve to indicate where the skyline should appear and will be found far superior to guesswork. This time a card is used to protect the printed foreground from unwanted light and, again, it must be kept moving whilst the sky is being exposed. In printing in the sky, there is even less room for exposure error than in printing the foreground and a mistake here will be much more apparent. Most operators tend to overprint at first, though it goes without saying that test strips from both negatives should have been made before operations commenced. It is true that with experience one may become surprisingly expert at judging exposures, merely by looking at the projected image. It is equally true that the necessity for scrapping a large and costly sheet of bromide is a blow to most of us, so that a simple test is a safeguard to one's pocket—and peace of mind!

The foregoing remarks have been purposely simplified and assume a fairly even, unbroken horizon into which the selected sky is allowed to merge gradually and imperceptibly. They have taken no account of probable elaborations such as trees, buildings, and other more or less complex shapes on the skyline. The chances are, of course, that it will be much more exciting and that we may expect trees, at least. If our original negative has the dense, bald sky mentioned earlier

and consequently requires no shading, the trees, etc., may be ignored when we mark the horizon with the suggested pencil dots. True, when superimposing the new sky the trees will be overprinted with the second exposure but unless this has been grossly exaggerated, the effect will not be noticeable in the final result.

Where the original and unwanted sky is so thin in the negative as to necessitate the use of the shading card, we shall have to resort to a more elaborate technique for we must now virtually change the background without affecting any other part of the picture. It is this most valuable extension to the over-printing process that we shall now examine.

Substituting Backgrounds

The unhappy frequency with which a photograph fails to be a picture merely because of an unsuitable background is probably all too well known to most of us. Or some discordant note will drag the eye away from the centre of interest and, in extreme cases, becomes itself the focal point. In the latter instance, skilful retouching may provide the remedy, though only the fortunate few can embark upon such an operation confident of emerging with the desired result rather than a ruined print or negative. When the entire background is at fault, we must turn to substitution and supply what we want by double-printing from a second negative. To achieve success in this fascinating process, we must have an enlarger which is in tip-top condition, particularly as regards its rigidity. We shall also require an ample supply of another valuable commodity—patience. These are the principal ingredients and they are not unduly difficult to mix. The method is an amplification of the previously discussed sky-printing technique but, since in all probability, the new background has to surround figures of complicated shape, and tightly at that, we need precision working of a high order.

The example we have selected to illustrate the method is shown on page 149 which in its original form is a totally unconvincing portrait of a gentleman in fisherman's clothes. It is unconvincing because the figure is out of his natural

surroundings and presumably is looking aloft at the weather. But as there is no weather visible, the whole thing becomes pointless—at least, until we introduce a suitable background. We begin by focussing the portrait negative on to the baseboard, selecting the size required and taking normal care over the definition. Next, we arrange a sheet of clean plate-glass as large as or larger than the print, about 1 in. above the board. Upon the glass we lay, and temporarily fix with adhesive tape, a sheet of thin white card, drawing paper or even white blotting paper. The image will now be seen slightly smaller and less sharp than before, but the focussing must not be disturbed. Now trace in pencil on the card a careful outline of the figure and such portions of the negative as you wish to retain. The next step is to remove the card and cut along the pencil line as accurately as possible. You will later discover that there are often large portions of negative where meticulous accuracy is not necessary as, for instance, along the line of a sleeve. In fact, an opportunity occurs here to eliminate the concertina-like effect which so often appears in sleeves. In other places, however, the need for extreme care in making the masks cannot be over-emphasised. If the face is in profile, it is astonishing how little one may depart from the true line without completely changing the appearance of the model.

When the mask is cut we shall have what, in engineering parlance would be termed male and female portions, one masking the figure, the other the background. Taking the upper portion, we re-lay it on the glass in perfect register with the projected image and by means of the invaluable adhesive tape we fasten it securely to the glass. It may be that the mask has various projecting points which will tend to spring upwards; in the interests of perfect register some means must be found of keeping these flat on the glass. Small weights are not difficult to devise and ordinary wire nails will be found satisfactory for the more slender projections. Adhesives are not to be recommended because of the consequent necessity to clean the glass in the dark before the companion mask can be used.

We should now be ready to make the first exposure and to have arrived at the stage where the unexposed bromide paper is placed in position on the desk. Whatever means are chosen for doing this, the sheet must remain absolutely steady until both exposures have been made. The slightest movement of the paper between exposures and all your care in making and positioning the masks will have been thrown away. It goes without saying that tests should have determined the correct exposures for both negatives before you commenced operations and if this is so, the figure may be exposed.

Recapping the lens with the safety filter, we change the negatives, taking great care not to disturb the set-up by the smallest amount. Next we take the companion mask and fit it exactly to the first one. The fitting must be accurately done or the joint will be quite clearly visible on the developed print. When you are satisfied that a really good fit has been achieved, fasten down the new mask and carefully remove the old. The second exposure may now be made. It should be very obvious that success depends entirely on the immobility of all parts of the equipment—and particularly of the glass—throughout the entire operation. Properly carried out, it is next to impossible to detect the joint. The distance between bromide and glass has been recommended as 1in which in practice seems a satisfactory choice. A larger space may impart too fuzzy an effect to the outline whilst anything closer will probably give too sharp a line, lending a 'stuck-on-afterwards' appearance. As in selecting sky negatives, the new background must be chosen with a wary eye to its suitability, both as regards character and lighting. On page 149 the background selected was a holiday beach snap complete with its own figure which is now hidden behind the fisherman. He, be it noted, has now begun to 'live' since he was placed in a more natural setting.

A Double-printing Device

One of the difficulties of the double-printing process is undoubtedly to be found in the changing of the masks which

must be so carefully matched with nothing more satisfactory than the meagre light passed by the enlarger's safety filter. The simple device now to be described was designed to overcome this particular snag and by its use, the safety filter may be swung out of the way and the matching carried out in the white printing light; and all without fogging or disturbing the bromide paper. Reference to the pictures on page 150 will show two brass channels down the long sides of an ordinary enlarging frame. On these channels are soldered upright lugs whose sole function is to hold and retain the plate-glass sheet. In operation, the whole frame is fastened down to the baseboard, again using adhesive tape. The first negative is masked exactly as we have already described and since the metal retaining frame is hinged, the bromide paper may be placed without disturbing the position of the glass or the mask. When the first exposure has been made, a sheet of card is inserted in the bell mouths of the brass channels and easily slid along to their extremities, so that the underlying bromide is completely protected.

There is now no need for the safety filter, which is removed and, if desired, the lens may be opened to its widest aperture. The added ease with which the masks may be changed in the vastly superior light is worth every minute of the time spent in making this simple attachment to an ordinary frame. Once the second mask is in position, the safety filter is replaced, the lens stopped down to its former aperture, the protective card withdrawn from the channels and the exposure made. It is realised that the mere reading of such a set of instructions as the foregoing may perhaps convey the unwelcome impression of a very long drawn out business indeed. 'That's alright,' you say, 'for the fellow who enjoys playing about, but I like to spend as little time as possible in the dark-room.' And now we sympathise! The truth is, however, that unless the first negative is a sheer miracle of complexities, the whole job, including the making of the masks, will add less than fifteen minutes to the original task.

Removing Distractions

It may be of interest to see how, by means of these processes,

a mediocre landscape shot was turned into an exhibition picture which had been honoured with several distinctions. The photograph on page 151 was taken in London's Trafalgar Square and whilst happy in its sky and placing of the clouds, it is utterly ruined by the eye-distracting mass of South Africa House, just on the extreme right of the fountain. The negative was printed through the plate-glass sheet on which was placed a small mask. This was cut to cover the unwanted building, its left and bottom limits being the edge of the fountain jet and the top edge of the basin. The top edge of the mask was cut to a nondescript shape which might conceivably correspond to a low cloud formation. The complete area is shown by a dotted line and as will be seen, is not particularly large. The counter-mask was then fitted but instead of using a second negative, the original was shifted in the carrier so that the dotted portion of the sky appeared over the area to be altered. Careful exposure tests had been made so that the new area would print as approximately of the same density as its adjacent surroundings.

The final print showed traces of the joint but these were easily lost by means of a little dye retouching. Signs of South Africa House could still be seen between the multi-jets of the fountain but were eliminated by local treatment with Farmer's reducer. It should be noted that the treated print has now a unity which was sadly lacking in the original photograph. Although the process, like all others, has its limitations, it has also enormous possibilities and used with discretion, can undoubtedly discover worthwhile pictures among the average stock of neglected negatives. In the examples cited, no more than two negatives were used although this number by no means represents the limit. So much depends on the ingenuity of the operator and his capacity for the previously mentioned 'playing about'.

Multiple Printing

Students of the cinema will probably be familiar with many of the devices to which film people resort as a matter of routine when faced with the need for effects which cannot

vell be photographed by straightforward means. In the film tudio, trick or 'special effects' technique is usually employed o secure scenes which in actuality could never happen or vhich could only be recorded through the expenditure of rohibitive sums of money. Although in the practice of still hotography there is less excuse for the production of such ear-miracles as are wrought in the cinematic cause, there ccasionally arises the need for some special treatment which rankly savours of screen-trickery. Usually, the effect involves nultiple printing or some modification of the methods we have lready described.

Plainly, there can be little to offer in the way of cut-and-ried rules and perhaps our best course is to take a definite xample and describe its making, step by step; which brings s to ' Bubble Fantasy ' reproduced on page 155. Although he picture has won a measure of success, it was originally isualised more as an exercise in technique than an attempt o produce something unusual. The picture as planned had o consist of a vast and lofty stage, an outsize in bubbles and he figure of the dancer lit by two spotlights directed from the vings. The curtain-draped stage presented no difficulty; there vere plush curtains in the author's small dining room and vith the camera at floor-level (to preserve the desired per-pective) a single Photoflood lamp directed on to the ceiling ave the background. The figure was more difficult, for the equired pose was not easy to hold even for a half-second's xposure. The revealing study on page 154 shows how it was nally managed. The bubble itself had obviously to be made f glass and proving quite unobtainable at the time, was ltimately blown from a piece of tubing held in a gas-flame. he next step was to make positive transparencies from the ancer and bubble negatives, a simple routine job, using ow 'ordinary' plates on the enlarger easel instead of bromide aper.

After these were processed and dried, their backgrounds ere completely painted out with one of the preparations pplied for such purposes. The blocked-out positive trans-arencies had next to be re-photographed on to one negative,

their exact positions having been pre-determined. It was at this stage that their relative sizes were chosen. Their positions were marked on the focussing screen of the camera used for re-photographing and the dancer-positive was first fixed in front of a lighted square, everything but the actual figure, of course, being obliterated. The figure was carefully focussed on to the left-hand bottom corner of the screen and the exposure made. Using the same method, the bubble-positive was photographed on the upper right corner of the same plate. The resulting print from this composite negative is shown. A simpler method would have been to make enlargements of appropriate size from the original negatives, cut them out and paste on to black paper, the whole print being then copied. Unfortunately, it is scarcely possible to make from a print a copy-negative equal in quality from one made by re-photographing good transparencies and the additional trouble was considered worthwhile.

When the background negative and the new one bearing the two principal objects were carefully cleaned and fastened face to face, we were ready for the final enlargement, though even this called for something more than straight method. The beams from the unseen spotlights had now to be introduced and, to achieve this effect, a sheet of glass was interposed between the lens and the bromide paper. On the glass were laid two strips of card, cut to shape so as to throw shadows in the form of the desired shafts of light. These strips were left in position during one-third of the total exposure and removed for the remainder. The spotlight effect was therefore secured by local under-exposure. As to the side-curtains and the over-head pelmet, it was only necessary to cut a piece of card to the inner shape, place it in close contact with the exposed print and fog the projecting border of the paper by flashing.

Admittedly, the print was troublesome to make and the picture itself is probably unworthy of so much detail work. But there is no doubt about the effect of such an exercise in the improvement of one's technique and much can be learned from an occasional adventure of this kind. For instance in ' Bubble Fantasy ', it will be noticed that due to the inter-

Here is shown some of the effects that can be obtained by the use of texture screens. The screen is held in contact with the printing paper during exposure, a sheet of clean glass being used to secure perfect contact all over.

Above: A very ordinary shot taken at an airport. The completely bla
sky makes the picture quite unappealing. *Below*: A print made from t
same negative with the aid of the masking device described in the tex

often desirable
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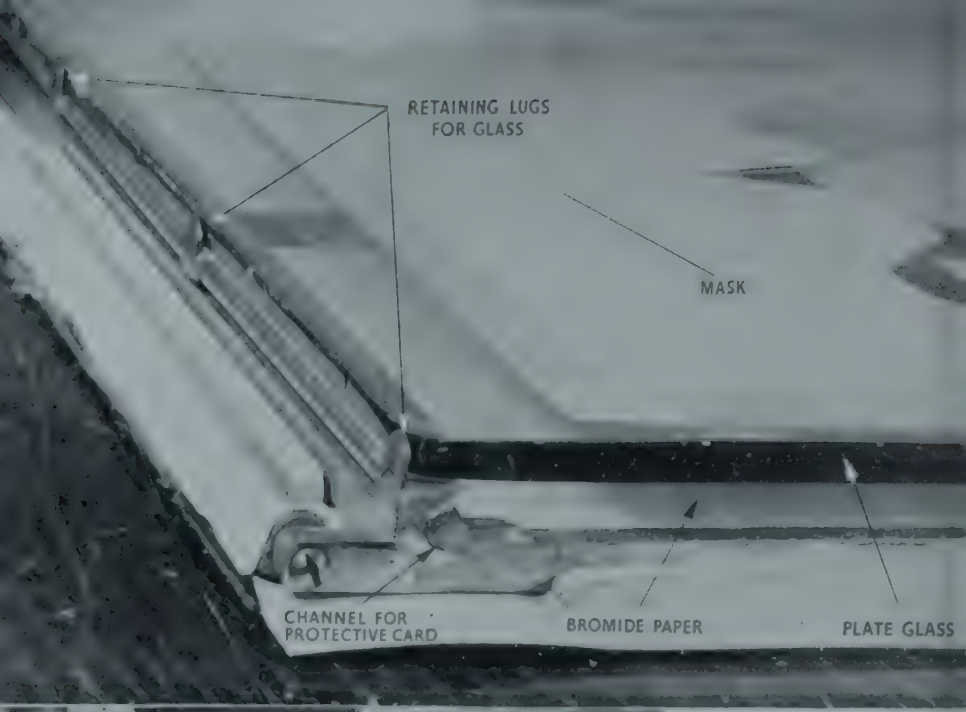
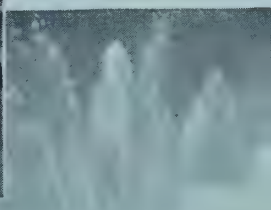
the subject.
has been done
to good effect
the methods
are described
age 140.



Above: This picture shows the essential details of the combination printing device described on page 143.

The photograph shows the use of the modified masking frame described on page 143. The sheet of opaque card enables masks to be changed without the safelight filter being in position in front of the enlarger lens.



e removal of the
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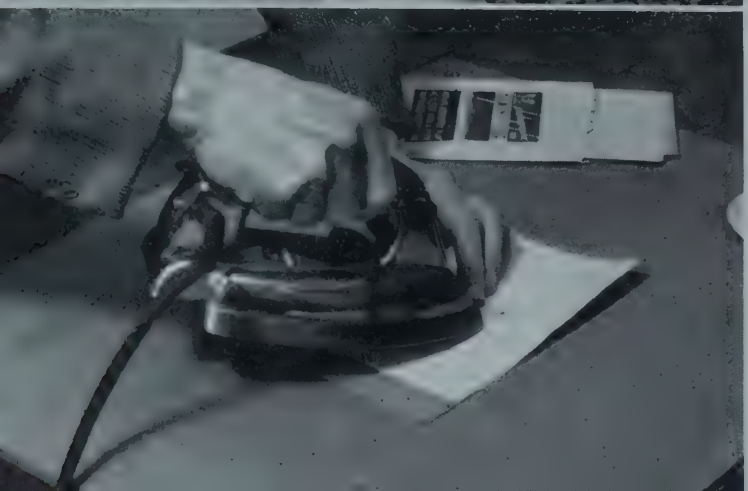
accomplished quite
ply with the aid of
double printing
ice described on
e 143.

These two prints show how converging verticals and similar distortions can be corrected by manipulation of the enlarger. Above is a straight print from a negative made with a twin-lens reflex camera which had to be tilted in order to include the top of the building. In the print opposite the converging verticals have been made parallel by tilting the enlarger head as explained in the text. Notice also how a picture has been created by trimming off the ugly wall at the right and by printing in an appropriate cloud.

These are the component parts of "Bubble Fantasy" reproduced on the opposite page.

"Bubble Fantasy", a composite print made from several negatives as described on page 145.



PRINT DRYI

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OUNTING

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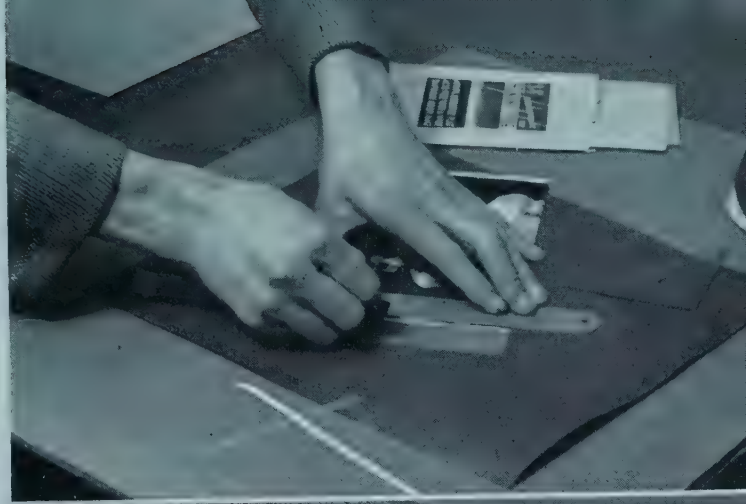

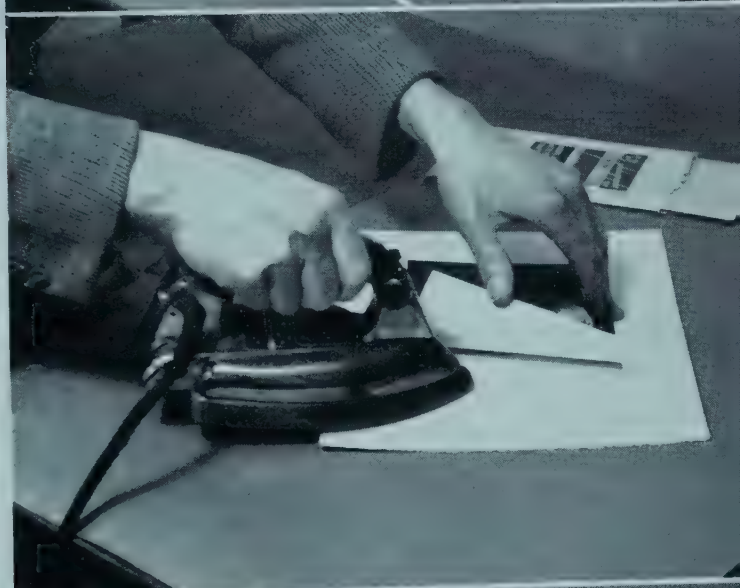

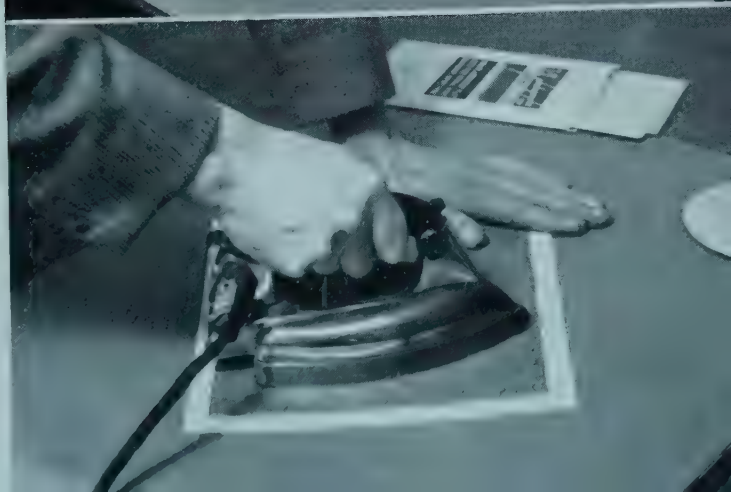

COLOUR PRINTS

A set of prints from a set of colour separation negatives. Such prints, carefully balanced, are needed in several colour print processes. The grey scale is matched accurately in order to secure good colour balance. In this set of prints the scale has been trimmed off.

position of the 'spotlight' strips, the figure of the dancer would receive only two-thirds of the total exposure. To offset this deficiency, her portion of the multiple negative had to be made thinner than the bubble area, the adjustment being made by modification of exposure when making this negative.

Montage

Here is a word which, though loosely employed, is usually understood to refer to the process of cutting-out and sticking-on. The various components of the picture are collected, carefully trimmed and mounted in their respective positions on a support, usually another photograph. They are then copied in the normal way. Apart from the probability that the photographs are produced by enlargement, the montage process would seem to have no lawful place in a book of this kind. The actual assembly is simple, provided one has the essential gift of invention and the ability to preview the picture in the mind's eye. The real photographic skill is required in making the copy negative, which is another story—long enough for another book.

Chapter 8

PRESENTATION

THERE are frequent occasions when the photographer opens up his electric dryer and, picking up the dried print from the glazing sheet sees at a glance that the print is really and truly finished—it requires nothing more in the way of treatment. Its very subject may be of so accommodating a nature that even the minute but inevitable spots fail to show. Of course, this is only as it should be BUT—and there is no printers' type bold enough to reproduce that BUT! Quite early in Chapter 6 we discussed the probable frequency of the 'perfect' negative and the manipulation required for the production of the artistically satisfying print. Now, assuming that the authors' many injunctions have been taken to heart, we may suppose that a really good print has become *fait accompli* and the last stage reached. Unless the print is a spotless paragon on glossy paper and is required unmounted, we have still to face the final and, to many of us, the most interesting sequence of operations, for the print must be 'presented'. This may occupy anything from a few minutes to several hours, depending upon the photographer's skill as a technician and his conceptions as an artist.

If you have ever made two identical prints, carrying one of them through to the final presentation stage and, at last, comparing it with its untreated fellow, you will have learned the lesson of a lifetime. The degree of care lavished on presentation will somewhat naturally depend on the purpose for which the picture has been made, probably reaching the extreme when it is destined to adorn the walls of an important salon.

Sparkle from Reduction

There are many workers who use as a sort of final touch, a quick immersion of all their prints in a very dilute solution of Farmer's reducer which, as is well-known, is merely a plain hypo bath to which a small quantity of potassium ferricyanide solution has been added. In its normal concentration, Farmer's is a 'cutting' reducer, acting first and strongly on the high-lights of a print. It must therefore be used with great caution if trouble is to be avoided, for its action can be unexpectedly rapid. In a very weak solution, however, an immersion of about 10 seconds will very slightly clear the whites in a print with beneficial results. Our American friends have probably a whole string of colourful words to describe what happens, but the effect is to add a sparkle, which may be described as putting a little extra ZIP into the print.

The solution is prepared by dissolving a handful of hypo crystals in about 20 ozs. of water and adding sufficient potassium ferricyanide (ready dissolved in water) to colour the bath to a pale lemon yellow tint. If the print has already been dried it must be thoroughly soaked for not less than ten minutes before treatment begins. The operation may be carried out immediately after fixation, in which case all that is necessary is a good rinse in clean water before transfer to the weak reducer. It is wise to experiment with a few pieces of waste print before risking a good one, but if the bath is right, ten seconds immersion with gentle agitation will produce enough reduction. It must be borne in mind that although at this stage the change is not violently perceptible, the slightest excess will destroy for ever the delicate highlight detail, a lamentable fact which will be even more evident in portraits. In passing, it should be noted that once mixed, Farmer's reducer deteriorates very quickly and its life may be measured only in minutes.

Toning

Despite the fact that the black tones offered by a good bromide enlargement are very beautiful and satisfying, the taste of the artist will sometimes lead him to consider one or other of the

many available toning processes. The urge to tone is more marked among American photographers than the home product, a tendency which probably derives from the more factual outlook of our Transatlantic colleagues. It cannot be denied that judiciously handled, a seascape or a snow scene will at once assume an appearance of greater realism when blue-toned than would be the case with a black and white version of the same picture. If the idea behind a print is purely objective there would seem to be a definite case for toning the image to some colour at least approaching the overall hue of the scene, the ultimate in this respect being represented by a true natural colour print. But where the photographer's outlook is subjective rather than factual, he is unlikely to seek anything more gratifying than the very lovely tones afforded by a good straight bromide.

There are, as we have seen, subtle variations of 'black' to be had from such papers as Bromesko or Plastika, obtainable from nothing more complicated than variations of development; so that without recourse to toning, there need be no monotony. It must not be thought that the foregoing remarks are designed to disparage something which occupies an important and honourable place in photography but rather as an exhortation to use it with discernment and good taste. A print which startles the beholder through sheer novelty of colour will certainly attract attention; but comments are less likely to be 'How beautiful!' than 'How and why on earth did he do that?' So, the question, 'To tone or not to tone,' must remain a purely personal one for the photographer and having decided that he must, there are hundreds of formulae from which to choose. And here are a few of the best.

Sepia Tones

Sulphide toning is among the oldest processes and is probably the most popular of all. It is very useful for portraiture and for imparting a very definite warmth to sunlit scenes. The well washed bromide print is first bleached in the following bath:—

Potassium ferricyanide ...	25 gm. ...	2 ounces
Potassium bromide ...	25 gm. ...	2 ounces
Water to	250 cc. ...	20 ounces

The working solution is 1 part of the above to 9 parts water. The bleaching solution is poured over the print, which should be thoroughly bleached in about 3 minutes. The print is washed for not longer than 2 minutes, then transferred to the following toning bath:—

Sodium sulphide	50 gm. ...	4 ounces
Water	250 cc. ...	20 ounces

The working solution is 1 part of the above to 19 parts water. Toning commences immediately the solution comes into contact with the print and is complete in about 1 minute. Colder tones may be obtained with the sulphide process by first immersing the print in the sulphide solution for 2 minutes and then following with the bleaching and toning operations as above. In either case, the print must be washed for 10 minutes after toning.

* * *

Cold sepia tones may be readily produced by the hypo-alum method, as follows:—

Hypo	75 gm. ...	3 ounces
Potassium alum	12.5 gm. ...	½ ounce
Boiling Water	500 cc. ...	20 ounces

Having dissolved the hypo in the boiling water, add the alum slowly and stir continually. The solution is used at a temperature of about 120° F. and in its new condition is inclined to exert a reducing action on the print. This effect may be prevented by first toning a few waste prints in the new bath. Toning by this method is usually complete in about 15 minutes.

Brown to Reddish Tones

The Uranium Process. This has a tendency to intensify prints, an effect which should be allowed for when exposing them. Uranium toned prints are not absolutely permanent. The formula is as follows:—

A	Uranium nitrate	10 gm. ...	90 grains
	Water	1000 cc. ...	20 ounces
B	Potassium ferricyanide ...	10 gm. ...	90 grains
	Water	1000 cc. ...	20 ounces

The working solution is equal parts of A and B, plus 20 minims of glacial acetic acid to every ounce of the mixture. The prints must be absolutely free from hypo and when toning is complete, they should be washed in changes of *still* water until the yellow discolouration has entirely disappeared from the highlights.

Rich Brown Tones

The Selenium Process:

Powdered selenium ...	3.4 gm. ...	60 grains
Sodium sulphide	52 gm. ...	2 ounces
Water	500 cc. ...	20 ounces

It will be found necessary to heat the solution in order to dissolve the selenium. The toning effect varies according to the amount of selenium present in the bath—the less selenium, the more the tone will tend towards sepia.

Red Tones

Ammonium sulphocyanide ...	2 gm. ...	130 grains
Gold chloride	0.12 gm. ...	7½ grains
Water	120 cc. ...	20 ounces

Dissolve separately and add the gold to the sulphocyanide.

Prints for this method must first have been toned sepia by one or other of the sepia processes previously noted. The ammonium–gold solution is then poured over the surfaces of the wet prints. Having arrived at the desired colour, the prints are next rinsed, fixed in an ordinary hypo bath and well washed.

Warm Brown to Reddish Tones

	Copper sulphate	7 gm. ...	60 ounces
A	Potassium citrate	28 gm. ...	240 grains
	Water	1000 cc. ...	20 ounces
	Potassium ferricyanide ...	6 gm. ...	50 grains
B	Potassium citrate	28 gm. ...	240 grains
	Water	1000 cc. ...	20 ounces

To make the working solution, take equal parts of A and B. In this bath, the prints, which must be very thoroughly

washed, will be seen to pass through a series of shades from a purplish black to a very decided red.

Deep Blue Tones

This is a somewhat expensive process but one which yields very beautiful rich blue tones. It is much favoured by American workers, though its possibilities are now being increasingly exploited by British photographers.

A	Thiocarbamide	3.4 gm. ...	15 grains
	Water	250 cc. ...	5 ounces
B	Citric Acid	3.4 gm. ...	15 grains
	Water	250 cc. ...	5 ounces
C	Gold chloride	1 gm. ...	15 grains
	Water	250 cc. ...	5 ounces

The working solution is prepared by taking 1 oz. (25 cc.) each of A, B and C, and adding 10 oz. (250 cc.) of water, the amount being sufficient to tone three prints, 10in. × 8in. It is a slow process, requiring some 20-30 minutes for bromide papers, although prints on chlorobromide papers tone more rapidly and with greater effect.

Blue Tones

The following formula will yield blue tones very much brighter than by the gold chloride process, but less rich in character.

	Potassium ferricyanide ...	1 gm. ...	15 grains
A	Sulphuric acid	2 cc. ...	30 minims
	Water	500 cc. ...	20 ounces
	Ferric ammonium citrate ...	1 gm. ...	15 grains
B	Sulphuric acid	2 cc. ...	30 minims
	Water	500 cc. ...	20 ounces

Working solution consists of equal parts A and B, mixed just before required. The print must be thoroughly washed and somewhat lighter in density than would normally be the case, since the process has a very definite intensifying effect on the image. Toning is quickly complete, after which the yellowish stain is removed by washing.

A	Potassium ferricyanide ...	2 gm. ...	180 grains
	Water, distilled	100 cc. ...	20 ounces
B	Vanadium Chloride (stock solution)	3 cc. ...	3¼ drachms
	Ferric ammonium citrate (green)	1 gm. ...	45 grains
	Sodium citrate	25 gm. ...	2½ ounces
	Ammonium chloride ...	2 gm. ...	90 grains
	Hydrochloric acid (1.16 s.g.)	14 cc. ...	1½ ounces
	Water, distilled	100 cc. ...	10 ounces

The vanadium stock solution is prepared by mixing 1 oz. of vanadium chloride in 18 ccs. (5 drachms) of concentrated hydrochloric acid and finally adding distilled water to a total of 62 ccs. (2 oz. 90 minims).

The working solution is made as follows:—Mix 1 part A with 4 parts water. Then, separately, 1 part B with 4 parts water. These two solutions are then combined to form the toning bath. Constant agitation is recommended throughout immersion of the prints, the tone being secured in about 6 minutes. On completion, the prints are well rinsed, then immersed in a weak hydrochloric acid bath (1 part acid to 50 parts water) for 2 minutes, and finally washed for 15 minutes. In the green toning process, the washings, both intermediate and final, are best carried out in several changes of water, rather than by the more usual running water.

* * *

It may here be observed that with the possible exception of the hypo-alum process, the aforementioned toners can be purchased ready for use.

"Colourform"

We can hardly take our leave from the subject of toning without making reference to the highly ingenious 'Colourform' method of Johnsons of Hendon Ltd., though, strictly speaking, this is not a toning process at all. There appears to be practically no limit to the range of colours obtainable and these are brighter than are obtained by ordinary toning. The 'Colourform' outfit consists of a bleaching agent, a special

developer and three chemical agents which, when added to the developer in small and carefully measured quantities, will convert the bleached image to one of the three secondary colours. It will be seen, therefore, that by adding various predetermined mixtures of the three colouring agents, practically any tone may be secured. The makers' instructions are very clear and detailed, and we are indebted to them for much additional information. There is no suggestion that the process can be used to produce an imitation of a natural colour photograph but certain types of subject can be treated broadly to give very effective results. This applies particularly to commercial subjects which are largely of one or two colours, such as cars, fireplaces, fabrics, furniture, etc. By the use of a suitable resist, two or three colours may be added and owing to the fact that the colour depth varies according to the tone or depth of the original silver image, a passable substitute for a colour photograph is not too difficult of attainment. Unusual effects are to be had by treating portions of the print with 'Colourform' and bleaching away the silver locally. This is useful in the preparation of posters, showcards, diagrams, etc. The actual colours produced from a given mixture will vary slightly according to the make and type of printing paper, though these differences are not considerable. Although variations of colour are observed through differences in temperature, the actual temperature is not critical and is only important where a definite colour is required to be matched precisely through a whole batch of prints.

Reinforcement of Tones

In the writer's view, there is no substitute for first-rate technique and, in a properly made print, there should be no need for this business of reinforcing the shadows by after-treatment. Certainly, the use of one or other of the several reinforcing dodges is by no means uncommon, as a visit to almost any photographic exhibition will show. Viewed from certain angles, an unskilfully treated print is all too obvious. However, one of the really nice things about photography is the wide variety of ways in which one can please oneself, so

if you must reinforce, here are methods of doing it. First, a suitable medium must be obtained or prepared. A reliable ready-to-use example is Printamol or one's own may be mixed from equal parts of good quality linseed oil, mastic varnish and turpentine. A quicker drying alternative is megilp, thinned with a little turpentine. In a small quantity of medium is mixed some artists' oil-colour, selected to match the tone of the print; lamp-black, ivory-black or a mixture of both will usually prove satisfactory, bromoil ink being equally good. The combined medium and colour is best applied to the print with a tuft of cotton-wool and, in order to avoid uneven application, the entire surface should be treated. The dope must be well rubbed in, with extra attention being given to the shadows, where the greatest effect is desired. The pigment compound is then removed from the highlights and lighter portions of the picture by wiping with another piece of cotton-wool bearing a certain amount of the clean medium. Small highlights may be easily cleaned up with a small brush.

Another method of reinforcement is being practised successfully by an eminent American child photographer, and is definitely a method requiring considerable skill and artistry in use. His method appears to consist of making first an excellent soft print, carrying all the delicate gradations of the lighter tones but completely lacking a true black or anything approaching one. Then, in a few widely spaced places where, in a full-range print the blacks would normally be found, he applies black dye. The method requires great subtlety and skill, for though the black touches are quite small and infrequent, the total effect is unbelievably brilliant.

Spotting

No matter how carefully one works on the making of an enlargement, complete freedom from spots seems almost an impossibility. Clear spots in the negative which print as black marks should be retouched before printing begins, though in miniature work this is more easily said than done. It's all very well to say that black spots have no place on a print—nor have they. Nevertheless, there is a very fair chance that

there will be one, at least, and that it will occur in some glaringly noticeable place. 'Knifing' is a good method of elimination and a little practice with one of the specially designed retouching knives, or even a razor blade, will quickly bring proficiency. The great thing to avoid in knifing out a blemish from the dried print is actual penetration of the emulsion. When this happens, the resulting damage is difficult to repair, so that the gentlest of scraping actions is demanded if the operation is to be successful.

Another method, calling for even more practice, is chemical retouching. The print is thoroughly soaked in water and blotted, and the offending spot touched with the merest point of a small spotting brush which has been dipped in fairly weak Farmer's reducer. A gentle stippling action is used, commencing at the outer edge of the spot and working gradually and carefully towards the centre. In the left hand, it is well to have ready for immediate action a tuft of cotton wool, soaked in strong hypo solution. Rapid application of this will at once arrest the reducing action when it has proceeded far enough and, in this way, will lend a useful measure of control. Any subsequent signs of the work on the dried print may be rectified by means of a retouching dye or pencil.

The more frequently occurring white specks are less difficult to deal with and will always respond to the careful use of a small spotting brush and a retouching preparation. Excellent dyes and water-colour pigments are available for the purpose and very little skill is required to 'lose' even a large blemish. Neither dye nor pigment should be used too strong since several applications of a weak solution are infinitely superior to one glorious blob. A sharply pointed retouching pencil is favoured by many and to some workers is the only satisfactory means. The only snag arises when the pencil-spotted print is to be treated later with an oil dope, when pencil-marks tend to be wiped off. This may be prevented by holding the spotted area of the print in a jet of steam, as from a boiling kettle, for a few seconds. The action, of course, is partially to melt the gelatine surface which, on cooling again, locks the pencil-marks firmly enough to resist rubbing action.

Doping

Practically all prints, except those made on glossy or near glossy paper are noticeably improved in brilliance by doping as a final touch. Suitable mediums for the purpose are to be found in the section on reinforcement and a small quantity of one or other is rubbed well into the print surface with a piece of cotton-wool. The treated print will require some hours for drying and before placing it between dustproof covers and setting it aside for the purpose, take care that there are no uneven patches or finger-marks to dry themselves into an unwelcome permanence. The effect of increased brilliance is naturally more marked in the case of matt-surfaced papers but the 'rough lustres' and similar papers have much of their wet appearance restored by the application of an oil dope.

Mounting

So many fine prints are more or less ruined by indifferent mounting technique that a book on the subject of enlarging would be strangely incomplete without reference to this most decisive of finishing touches. The actual positioning of the print on its mount must always be an intimate matter between the artist and his picture though there are extreme individualists whose urge to be different leads them along startling paths. This accounts for the mercifully rare freak mountings, such as a 10in. x 8in. print in the upper left-hand corner of a 20in. x 16in. mount or a tiny print fringed with deliberately torn tissue paper and stuck dead centre on an oversize pink card. There are many diversions, legitimate and pleasing, if less sensational than these and, if in doubt, it is generally safe to adopt a setting which at least, has stood the test of time.

The print may be placed so that the width of the border is uniform at the top and both sides, with about 1½ times as much at the bottom. If a print is worth mounting at all, it needs not cleverness but cleanliness in its attachment—and that's about all. As to the actual methods to be employed, there are several, with dry-mounting as the probable favourite. It is not a difficult matter and is undoubtedly at its

simplest when a specially-designed press is available. But a dry-mounting press is a cumbersome piece of machinery not usually to be found in an amateur's darkroom.

An excellent substitute is to be had in an electric dry-mounting iron, which functions like an ordinary smoothing-iron and is usually temperature-controlled. Failing this, the domestic iron may be pressed into service and, handled intelligently, is capable of first-class results. First, a sheet of mounting-tissue of rather more than the required size is tipped on to the back of the print, and attached at several points by touching with an edge of the heated iron. The combined print and tissue may now be trimmed to the final shape and dimensions. For efficient mounting, the iron should be run at a temperature between 150° and 180° F. Anything much below this range will fail to melt the tissue, whilst really high temperatures may scorch the print irreparably. When mounting by hand, the movements of the iron should be firm but cautious in order to avoid the possibility of creasing the print. There is less danger of this with double-weight paper but an excellent chance of trouble with single-weight stocks, particularly in the larger sizes.

The face of the print should be protected from actual contact with the iron by the interposition of a sheet of clean, tough paper. The iron should be allowed to 'dwell' for about 10 seconds on each part of the print. A useful dodge in dry-mounting is to have close at hand a sheet of plate-glass or a fairly heavy metal plate. After ironing an area of the print for the prescribed 10 seconds, the iron is withdrawn and the glass or metal laid quickly over that part of the print. The sudden chilling effect seems materially to assist the adhesive properties of the tissue and helps greatly in the production of a permanent job of mounting. When the print is properly mounted and immediately after its final contact with the hot iron, it is a good thing to bend the mount for a few moments so that the face of the print takes a convex shape. This will prevent its natural tendency to curl as it cools off.

Next to dry-mounting, the use of one of the specially prepared latex or rubber solutions is probably best. They are

very simple and clean in use, respond well to the attentions of a roller squeege for smoothing purposes, whilst any superfluous solution on the mount or print can be very easily wiped off when dry. Of the commercial paste mountants it is only necessary to follow the maker's instructions and to ensure that the said maker has a reputation to lose. Cheap and doubtful brands have been known to contain chemicals which find their way through the support and finally ruin the photograph.

Titling

A vexed question this! Of all the finer points of presentation, nothing more clearly indicates the taste of the artist than the manner in which he labels his work. If you believe, as many do, that a good picture requires no title, the problem solves itself. But if you follow the general trend and regard a title as necessary to the work, you are probably just as right as the other fellow. One does occasionally feel one's gorge rising in indignation at some piece of flagrant bad taste, in which the title is so ornate that it cannot help but draw the eye entirely away from the picture. It is surely wrong to wax dogmatic about so personal a thing as the title of a picture but if one had to frame rules they would, no doubt, reflect the two principles of aptness and brevity. In connection with the former, one is reminded of a recent opus in which the remains of a sad-looking pineapple shared the composition with a not very attractive marble clock—and the title was 'Yesterday'. Heaven may have known what it meant but one is entitled to doubt that the author did!

Certainly, there is a palpable lack of originality and no exhibition is without its 'Sunkissed' or its 'Windswept'. There will also be a portrait of a lady looking soulfully out of an upper corner of the print. If she gazes left, the title will be 'Melancholy', and if to the right, 'Meditation'. Surely there is a happy medium between the too-too clever and the trite. On the score of brevity, one has in mind those rather unwieldy quotations which clutter up many otherwise excellent works. As poetry, 'The ploughman homeward plods his

veary way' reflects undoubted beauty but takes up far too nuch room on a mount. Similarly with the artist's signature, implicity rather than flamboyance should sound the key-ote; it should never obtrude. It is the practice of the authors o attempt a compromise by inscribing both title and signature uite faintly, the first letter of the former level with the print's eft-hand edge and the last letter of the signature in line with he right-hand edge. There is no objectionable impact and if viewer is sufficiently curious to learn the title of the picture r the identity of its author, he can be satisfied by a close nspection. Needless to say, lettering should be carried out vith meticulous care.

Border Lines

By no means all mounted prints are improved by surrounding hem with border lines, pencilled or otherwise, and he would e a brave man who attempted to lay down hard and fast ules. The beauty of most dark or low-key prints does seem nhanced by some such attention, probably because the break rom darkness to the contrasting light tone of the mount is ess abrupt. In any case, the first attempt should be drawn ightly enough to allow of erasure should it prove unsatis-actory. The multiple border of say, several faint lines and bold one is rarely helpful and the very complexity of such rnamentation may defeat its purpose by sheer irritation. The najority of high-key prints or those whose dominant tones re light will be improved by the addition of a reasonably old line drawn close to the edges. A well executed border vill often bind the whole thing together and prevent the eye rom wandering out of the picture. But the device should ever be regarded as an absolute necessity and every ndividual case will be found worthy of study.

Exhibiting

n this country, there are some 50 open photographic exhibi-ions held annually, many of them enjoying an international eputation for the high quality of the work displayed. They ange from the usually superb 'Royal' and London Salon to

the small two-day shows sponsored by the more enterprisin provincial societies. Obviously, the standard will vary fro show to show. The prints finding acceptance at the Roya amount to less than 7% of the total entry, so that successfu entrants are entitled to a glow of pride when their work honoured. The smaller shows will be happy to hang les masterly efforts though it is most unwise to submit off-standar work, merely because the show runs for two days in a sma town. In addition to the open events, there are hundreds o private exhibitions and practically all photographic societie stage their annual displays of members' work; and very fin some of them are.

The great benefit to be derived from participation in exhib tion work is found in the many lessons to be learned fro acceptance or rejection resulting from quite impartial judg ment. To have one's pet dream-creation turned down flat to receive a minor shock and until one grows accustomed to i is taken as a clear indication of the judge's incompetence– or worse! But when the same thing happens repeatedly, th wise photographer will take his failure to heart and set abou finding the cause—often with valuable results. Naturally there will be inconsistencies, but taken by and large, the goo print will score repeatedly and rapidly accumulate on it fortunate back an imposing array of acceptance labels. Onc again there are no rules for success, apart from the obviou one of never submitting a print which is not at least technicall excellent. A poorly produced print, whatever its subject, wi rarely pass the scrutiny of judges who are selected for thei skill in quickly distinguishing gold from dross.

A print intended for exhibition should be of rather stronge contrast than would be normally deemed 'right' and in size should be preferably not smaller than 15in. x 12in. on 20in. x 16in. mount. Apart from these points of size an technique, the qualities most likely to appeal are sincerit and originality. It is not very easy to offer really helpfu guidance in getting one's work 'in'; but a year or so spent i submitting prints is a salutary and valuable experience Announcements of forthcoming shows are to be found in th

hotographic press at regular intervals and secretaries will be nly too happy to send you the necessary forms and return- abels. Once your name appears in an exhibition catalogue as successful entrant, you will have no need to apply for forms. You'll get them, unsolicited, from every part of the world. In selecting your hunting-ground, you will soon learn to avour those organisations who limit the number of entries to maximum of four in any one class, for they are obviously ut for quality rather than quantity. Pack your prints well nd include materials for the return journey. Corners need dequate protection and a couple of stout stiffening boards are o extravagance where the safety of four valuable prints is oncerned. Exhibition work demands a very high standard nd for this reason alone, offers one of the finest means of mproving one's technique. So go ahead—industriously and vith confidence; and may good luck attend your labours.

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Chapter 9

ENLARGEMENTS FOR COLOUR PRINTS

In view of the growing popularity of the natural colour print, it is fitting that the making of the essential bromide enlargements should now be discussed in some detail. True, the method of their production is basically that by which the ordinary enlargement is turned out; but there are several points, ignored in black and white, which become of paramount importance in colour work. At the time of writing, there are at least two colour-print processes for which bromide prints must be made from the usual separation negatives, whilst a third demands enlargements made on special film material. Doubtless the not-far-distant future will see the introduction of further processes, possibly also calling for initial enlargements.

The Trichrome Carbro Process

For this, which is probably the most beautiful, albeit the most difficult method of colour-printing, the first essential is a properly made set of three-colour separation negatives. These will be closely similar in density and identical as regards their contrasts. They will also bear the image of the grey-scale (or step-wedge) which must be included in some convenient corner of the scene at the time of exposure. Ordinary bromide paper is not suitable for the Carbro process and the prints must be made on a paper which has not been super-coated as the usual precaution against stress-marks. Such a paper is obtainable from Messrs. Ilford in normal grade and from Messrs. Kentmere Ltd. in soft, normal and hard grades. Due to the absence of the protective coating, this paper

equires respectful treatment during processing if undesirable blemishes are not to prove a source of trouble. A necessity to the making of a good Carbro colour print is the ability of the three bromides to register perfectly with one another. Anything even slightly short of this perfect registration will result in ruinous fringes of one or more colours in the final print. Most Carbro workers will agree that the whole secret of success lies in the making of the bromide prints and the subsequent operations are sufficiently long and involved to make 'starting right' a mere matter of common sense.

To ensure extreme accuracy of registration, the first responsibility must rest with the maker of the negatives who, for this reason, will prefer to work with the more rigid glass plates rather than with film. Where the negatives have been made on film they must be printed through a glass negative carrier to preserve the perfect flatness that a glassless carrier could hardly provide. Again in our quest for perfect registration, some means must be found to guarantee absolute flatness of the printing paper, since the slightest curvature will introduce small inconsistencies of image size. This is more than ever true of the larger sizes of paper, where it may be found necessary to hold the sheet firm under a plate of scrupulously clean glass.

A white border of at least $\frac{1}{4}$in. all round is a practical necessity and this is usually managed in the masking frame, without undue difficulty. It is as well to point out another possible pitfall which may be avoided at this stage. When making the first of the three prints, trace on the masking-frame board two or three salient points of the projected image so that all three prints may be identically positioned with respect to the border. Failure to do this will result in wasteful strips having to be trimmed from all four sides of the final colour print, in order to get rid of the inevitable projecting portions of each separate colour-image.

The next operation in the making of the bromides is to insert one of the three negatives in the carrier and to focus in the normal way. It is wise to preserve the same sequence of operations at all times and most workers begin with the red-

filter negative (which produces the cyan-printing bromide). The type of print to aim at will be found by experiment, but the ideal is soft, but not flat, and of rather less than usual density. The step-wedge is included in the cyan-printing bromide as a guide to the making of the other two. The green-filter negative is next inserted and made ready for the magenta-printing bromide, and this is where our matching difficulties begin. The actual image is ignored and attention concentrated on the all-important step-wedge. Tests are made and developed until you have found the precise exposure to match exactly the wedge of the previously made cyan-printer. Having determined the time required, the magenta-printing bromide is made, developed and checked against the first one for accuracy, with due regard to both contrast and density.

The same procedure is followed with the blue-filter negative in order to make the yellow-printing bromide. If really uniform prints are to be obtained, there are several precautions to be observed, not least in connection with the constancy of the supply voltage to the enlarger lamp. In certain districts, this can be very troublesome since voltage variation need only be slight to produce considerable inaccuracies in the final colour rendering. In such a case, the only remedy is to instal a constant-voltage transformer which will hold the line voltage steady to within narrow limits. A further counsel of perfection would be to make all three step-wedge tests together, keeping a note of the exact exposures which would be used later in making the actual prints. These would then be developed simultaneously, for the same time, in the same bath. Where there is no danger of voltage-variation, this method is quite practicable and, indeed, provides a means of making the prints without the step-wedge appearing at all on the actual bromides.

When the prints are made separately, care must be taken to ensure ample solution in the developing bath, and a check kept on the temperature which must be identical for all three prints. Where there appears to be some contrast difference between the negatives, the prints may still be made uniform, provided the difference is only slight. Use may be made of

he two developer formulae herewith, which give noticeably different contrasts, with the same grade of paper.

For soft contrast:					
Metol	8.5	gm.	...	30	grains
Sodium sulphite (cryst.)	60	gm.	...	½	ounce
Sodium carbonate (cryst.)	100	gm.	...	2	ounces
Water to	1000	cc.	...	20	ounces
For greater contrast:					
Hydroquinone	10	gm.	...	90	grains
Metol	0.5	gm.	...	4½	grains
Sodium sulphite (cryst.)	72	gm.	...	1½	ounces
Sodium carbonate (cryst.)	140	gm.	...	3	ounces
Potassium bromide ...	3	gm.	...	25	grains
Water to	1000	cc.	...	20	ounces

A final hint may prove of value to the producer of Carbro prints and has to do with colour tissues used for the actual picture. These tissues deposit their respective colour-images on the transparent supports in proportion to the density of the silver image on the bromides, but vary somewhat, from batch to batch, in their ability to do so. In the batch of tissue at present in use by the writers, it is found that the cyan tissue deposits a stronger image than the red or yellow, so that in order to preserve a true colour balance, adjustments have to be made in the density of the cyan-printing bromide. In this particular case, the bromide print receives 10% less exposure than the other two. Having made the magenta-printer first, the equivalent exposure for the cyan-printer is determined and then reduced by 10% when making the actual print. If this adjustment were not made, the colour-print would emerge with a pronounced excess of cyan, giving a very cold appearance and destroying the truth of the colour rendering.

The density of the yellow-printer calls for a rather less degree of accuracy and can in fact be appreciably denser without seriously detracting from the quality of the final print. We have on occasion increased its exposure by as much as 30% when deliberately falsifying the colour-balance for the purpose of adding warmth or imparting a sunlight effect to a cold scene.

The "Tritone" Process

This excellent method of making colour-prints has lain

neglected for some time but shows signs of a return to favour. It, too, requires the use of three bromide prints though, in this case, they must be printed on Kodak Transferotype paper. Otherwise, the procedure to be followed is exactly as for Carbro, except that the latter remarks concerning exposure adjustments will not apply.

TABLES OF BROMIDE AND CHLOROBROMIDE PAPERS

BROMIDE PAPERS

BARNET

SURFACE	COLOUR OF BASE			GRADES AVAILABLE						Single Wt.	Double Wt.
	White	Ivory	Cream	0	1	2	3	4	5		
Enamel (Glossy) ...	*				*	*	*	*		*	*
Semi-Matt	*				*	*	*			*	*
Matt	*				*	*	*			*	*
Semi-Matt			*			*	*				*
Stipple Grain ...	*				*	*	*				*
Stipple Grain ...			*			*	*				*

CRITERION

Smooth Matt ...	*		*		*	*	*	*		*	*
Silky	*				*	*	*	*		*	*
Silky			*		*	*	*				*
Glossy	*				*	*	*	*	*	*	*
"Hylite" Press Glossy	*				*	*	*	*	*	*	*
Silky Stipple	*		*		*	*	*	*			*

GEVAERT

Matt Smooth	*				*	*	*			*	*
Matt Smooth			*		*	*	*				*
Matt Rough	*				*	*				*	*
Semi-Matt Smooth .	*		*	*	*	*	*	*		*	*
Semi-Matt Velvet ...	*				*	*	*			*	
Glossy	*			*	*	*	*	*		*	*
Glossy			*	*	*	*	*	*		*	
Royal Fine-Grain ...	*		*		*	*	*				*
Semi-Matt Silk Finish	*		*		*	*					*
Gevaluxe Velours ...	*		*			*					*
Semi-Glossy Grained					*	*	*			*	*

ILFORD

SURFACE	COLOUR OF BASE			GRADES AVAILABLE						Single Wt.	Double Wt.
	White	Ivory	Cream	0	1	2	3	4	5		
Glossy	*				*	*	*	*	*	*	*
Matt	*				*	*	*	*		*	*
Matt			*		*	*	*				*
Smooth Lustre ...	*				*	*	*	*			*
Smooth Lustre ...			*			*	*	*			*
Semi-Matt	*				*	*	*	*		*	*
Velvet Stipple ...	*				*	*	*	*		*	*
Velvet Stipple ...			*			*	*	*			*
Rough Lustre ...	*		*		*	*	*				*
Rayon	*					*	*				*
Rayon			*			*					*
Light-weight Lustre	*					*		*		Lgt	Wgt.

KENTMERE

Glossy	*				*	*	*	*		*	*
Matt	*				*	*	*				*
Carbon	*				*	*	*	*		*	*
Matt			*			*	*	*			*
Carbon			*			*	*				*
Rough Carbon ...	*		*			*	*				*
Silky	*					*	*				*
Velvet Stipple ...	*				*	*	*	*		*	*

KODAK

Glossy	*				*	*	*	*		*	*
Velvet Lustre ...	*				*	*	*			*	*
Smooth Matt	*				*	*	*			*	*
Smooth Lustre ...	*				*	*	*				*
Smooth Grain Lustre	*	*			*	*	*			*	*
Royal Fine Lustre ..	*	*			*	*	*				*
Rough Lustre ...	*	*	*		*	*	*				*
Air Mail Smooth Lustre	*				*	*	*			Lgt	Wgt.

AGFA

Glossy	*				*		*	*	*	*	*
Semi-Matt	*		*		*		*	*			*
Lustre	*	*			*		*	*			*
Royal Fine Grain ...		*	*		*	*	*	*			*

KOSMOS

SURFACE	COLOUR OF BASE			GRADES AVAILABLE						Single Wt	Double Wt.
	White	Ivory	Cream	0	1	Special	2	3	4		
Glossy	*				*	*	*	*	*	*	*
Glossy Extra Rapid	*					*					*
Velvet	*					*	*	*		*	*
Velvet			*			*	*	*			*
Semi-Matt	*					*	*	*		*	*
Semi-Matt			*			*	*				*
Rough Natural Surface	*		*			*	*				*
Matt	*					*	*	*		*	*
Matt			*			*	*				*
Silk Grain	*		*			*	*				*
Smooth Natural Surface	*		*			*	*	*			*
Smooth Natural Surface		*				*	*				*
Rough	*					*				*	

RAPID CHLOROBROMIDE PAPERS

AGFA PORTRIGA RAPID

Royal Fine Grain ...		*	*		*		*	*			*

CRITERION MEZZOTONE

Glossy	*					*	*			*	*
Silky	*		*			*	*				*
Silky Stipple	*		*			*	*				*

GEVAERT PRESTONA

Semi-Matt Smooth .	*		*		*	*	*				*
Smooth Matt ...			*		*	*	*				*
Platino Gravure ...		*			*	*	*				*
Royal Fine-Grain ...	*				*	*	*				*
Pelligran	*		*		■	*	*				*
Super-Matt			*		■	*	*				*

GEVAERT GEVARTO

A warm-tone paper specially designed for drying by heat. The colour of the image does not alter.

SURFACE	COLOUR OF BASE			GRADES AVAILABLE						Single Wt.	Wt. Double
	White	Ivory	Cream	0	1	Special	2	3	4		
Glossy	*				*	*	*	*		*	
Glossy			*	*	*	*	*	*		*	
Semi-Matt Smooth .	*		*		*	*	*	*		*	*
Pelligran	*		*		*	*	*	*			*
Semi-Glossy Grained	*		*		*	*	*	*			*

ILFORD PLASTIKA

Glossy	*				*	*	*			*	*
Matt	*				*	*	*				*
Matt			*		*	*	*				*
Semi-Matt	*		*		*	*	*				*
Rayon	*		*		*	*	*				*
Grained Half Matt	*		*		*	*	*				*

KODAK BROMESKO

Glossy	*				*	*	*			*	*
Velvet Lustre ...	*	*			*	*	*				*
Smooth Matt	*	*			*	*	*				*
Fine Grain Lustre...	*	*	*		*	*	*				*
Rough Lustre ...	*	*	*		*	*	*				*
Silk	*	*			*	*	*				*

KOSMOS BROMEGA

Velvet		*	*		*	*	*				*
Smooth Matt		*	*		*	*	*				*
Rough											
Natural Surface			*		*	*	*				*
Silk Grain			*		*	*	*				*
Egg Shell Grain ...	*		*		*	*	*				*
Smooth											
Natural Surface		*			*	*	*				*
Glossy	*				*	*	*				*

Note.—Kosmos Bromega is described by the makers as a bromide paper, but as it gives warm tones by direct development it can be regarded as a fast chlorobromide paper.

INDEX

'Bromesko' paper is the favourite for exhibition enlargements because of its extremely long tone range . . . because it gives warm or cold tones by direct development . . . because it is available in 13 different tint/texture/surface combinations.

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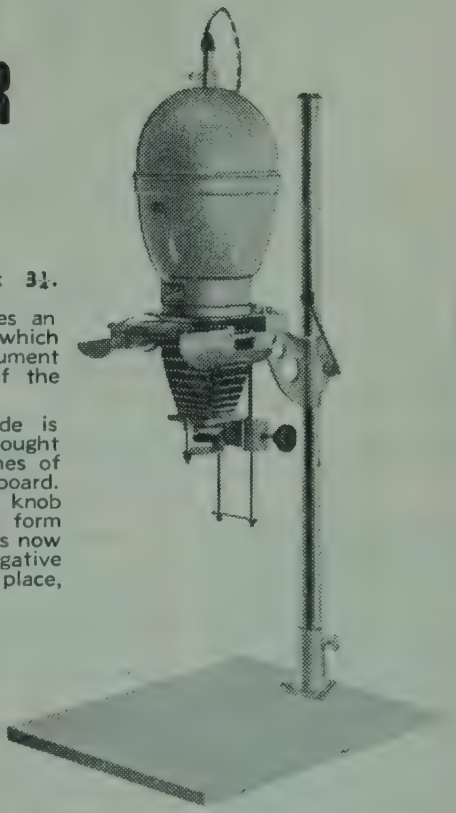

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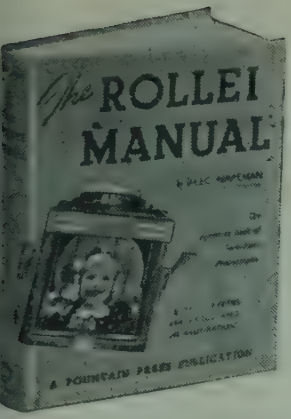

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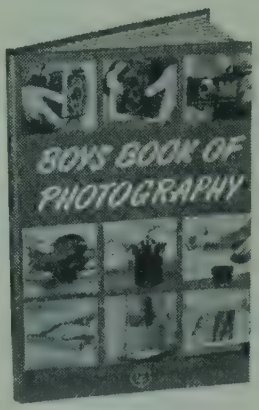

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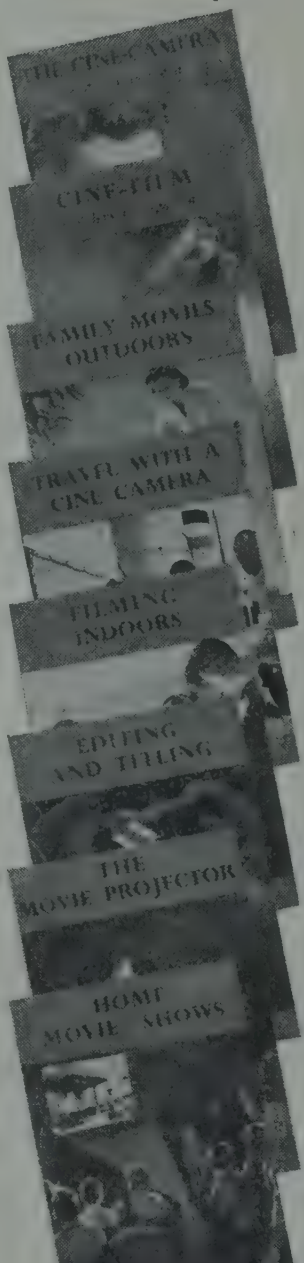

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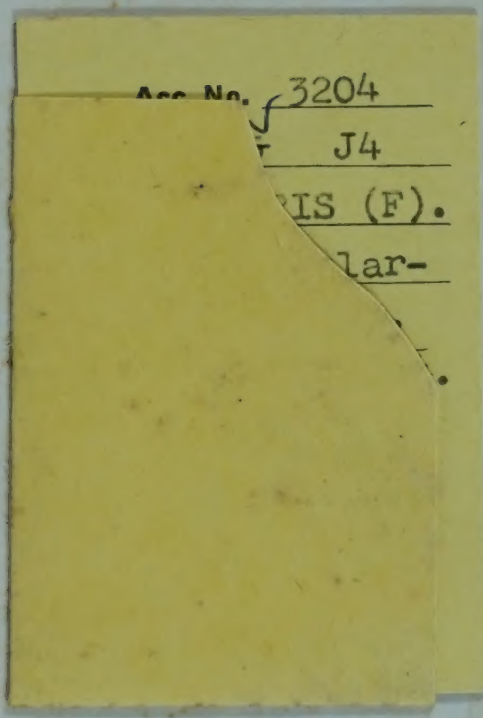
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